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THE FOUNDRY

Established in 1892 by John A. Penton

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THE FOUNDRY for August

In Good HANDS

MOMENTOUS questions confront every foundry operator these fast moving tumultous times. They press for answer from employes, from customers, from government agencies and, unfortunately, from sources where individuals are actuated by the hope of personal gain. Application of the National Industrial Recovery act with its many ramifications is of vital portent to every foundry in the United States. It is a national measure, fraught with perplexities. The machinery of administration centers with the Federal government. It recognizes organization of industries upon a national basis. Therefore, one question often encountered, should be clearly and firmly answered. The proper procedure in all matters of an individual foundry's action lies through the national organization of his industry. Local, sectional and small group interests should be abated and so far as the foundry industry is concerned, recognition and co-operation should be given the national organizations set up in the gray iron, steel, malleable and nonferrous foundry industries.

Facts and FIGURES

THE malleable and steel foundry branches of the industry through longer activity in trade association work and by reason of the relatively fewer number of plants, are fortunate in possessing records and statistics covering a number of years. THE FOUNDRY frequently has pointed the need of adequate facts and figures relative to the gray iron and the nonferrous foundry industries. An attempt of a government department a number of years ago to accumulate statistics covering the gray iron foundries failed. The failure was due in some measure to the disinclination of foundries to answer questionnaires. One of the men who handled this work for the government stated that this was due to clerks or minor employes being intrusted with the mail and either destroying or returning the questionnaires unanswered. He said the matter of personal inconvenience, the avoidance of work contributed in large measure to this failure. THE FOUNDRY has been asked to accumulate data and figures in support of the gray iron industry, on a confidential basis, and to provide summaries and totals upon which the gray iron code may be supported. These questionnaires are in the hands of all gray iron foundries and self interest should demand that each be answered by a competent person. Nonferrous questionnaires sent by the Nonferrous Foundry association deserve similar attention and prompt answer.

Prickley QUESTION

FOUNDRY owners and treasurers of all institutions are scratching their heads over the problem of declared capital value of their businesses. A capital tax is applied assessable upon this declaration. If they make this value low in light of depleted assets and washed out inventories, they decrease the amount of the capital tax. However, if they make money this year they face a whacking excess profits assessment. If they lose money this year and next the depreciation applies against the declared capital value and then a year's earnings—if the law is in existence that long—will cut deeply. The answer? Ask some good firm of accountants.

Whats New in AUGUST

AUTOMOBILE foundry pours 12-cylinder block in mold assembled from cores and handled as a unit (page 10). British Foundrymen consider metallurgical problems (page 13). Industry progresses toward N.I.R.A. codes (page 14). Brings data on phosphorus up-to-date (page 16). A navy officer views European steel foundry practice (page 19). Nonferrous association formed (page 23).

Fig. 1—This entire set of cores is assembled as a unit and lowered into the green sand mold

Core Assembly Handled as Unit

Special jig enables molder to anchor set of cores for twin six auto engine block

AUTOMOBILE engine cylinder blocks probably represent in many respects the highest development achieved in the gray iron foundry industry. Accuracy of dimension, limited thickness of metal, absolute homogenity, machinability, and entire freedom from flaws of any description either interior or exterior, present to the foundryman a compound and complex problem without comparison in other sections of the foundry field. The problem usually is further complicated by the necessity of producing the castings in large numbers with the aid of workmen without former foundry training and who have to be instructed in certain limited specific duties.

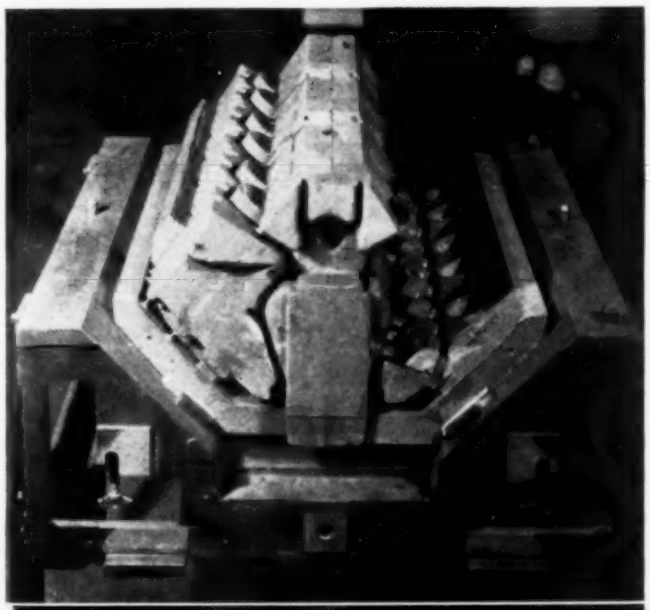
Methods Have Been Analyzed

To meet these conditions the foundryman, the patternmaker and the manufacturer of foundry equipment have collaborated in the past. Methods and processes incident to the sequence of operation in the production of the castings have been broken down and analyzed, divided and subdivided. Where the efforts of each workman are confined to a small, repetition operation,

Fig. 2—The core assembly is suspended by long bolts extending from the bottom core to the bridges on the upper jig

most of the hazard incident to the human element is eliminated. Naturally, also the workman quickly acquires a high degree of speed and skill in his particular specialty.

The old easy going practices of the past where fins were anticipated and tolerated, where allowance was made in the corebox for the core swelling, where the core prints deliberately were made over size for clearance, where over size cores were filed by hand and under size cores were ornamented with clay or dough worms to secure a *touch*, these and many other practices tolerated in the past, have been relegated to the limbo of forgotten things. Patterns and coreboxes must conform accurately to dimensions.



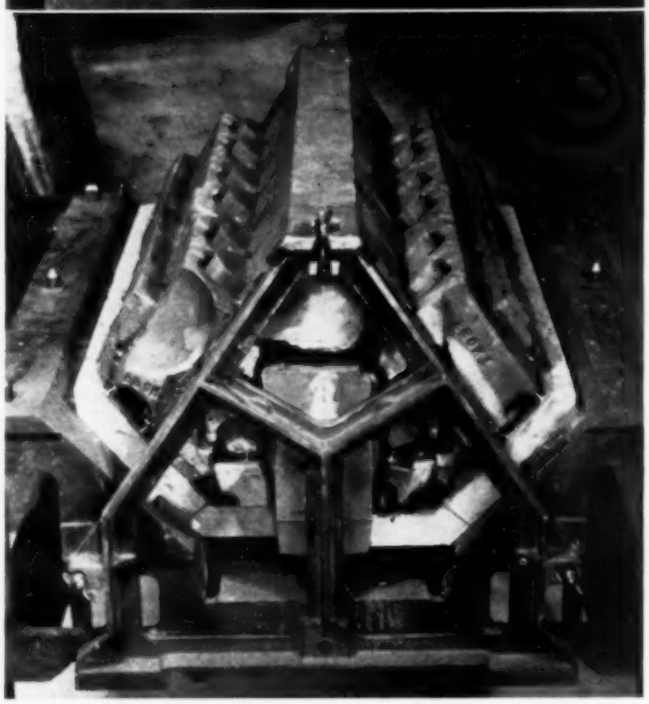


Fig. 3 (Above)—Commencing with a slab core in the bottom the cores are built up from both sides of the cast iron jig. Fig. 4 (Below)—End pieces on the jig serve as guides for sliding straight-edges

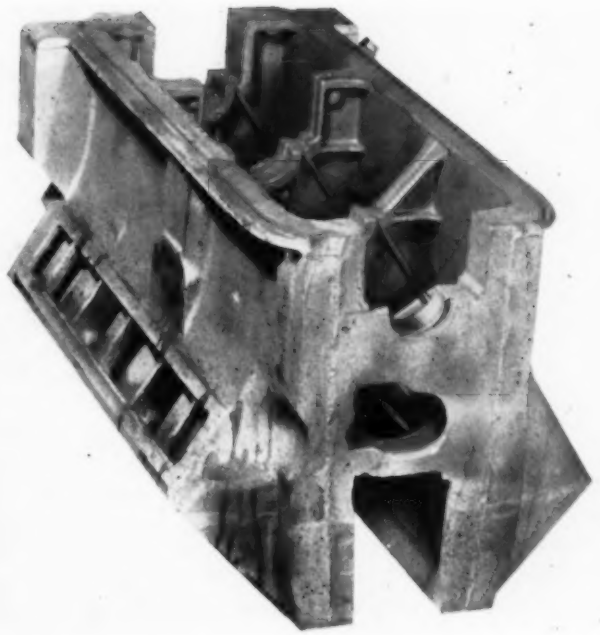


Fig. 5—One of the castings showing detail of the main bearings and brackets in the upper part of the crankcase

Cores do not swell or shrink. They fit snugly in the prints without the aid of a file or a dough worm.

Extremely accurate core construction is particularly essential where a group of cores is assembled to form such a complicated casting as the cylinder block for an automobile engine. The practice of assembling a partial or complete set of cores before lowering them into a mold as a unit is not new or original. The idea has found favor at various times and under many conditions in the foundry field, but probably the most remarkable exemplification of the practice is that now in vogue at the plant of the Packard Motor Car Co., Detroit.

Casting Formed Almost Entirely in Cores

With the exception of a somewhat limited area on each side and on top the entire face of the 12-cylinder casting inside and outside is formed by dry sand cores and the entire core assembly is handled and placed in a green sand mold as a unit.

An appreciation of the astonishing number of cores in one of these assemblies and a realization of the accuracy of construction of the cores and coreboxes, the ingenuity displayed in locking the cores together, the elaborate jigs and other mechanical equipment which practically eliminate all hazard of the human element, may be had by a study of the various illustrations.

A complete set of cores before assembly is shown in Fig. 1. A set partly assembled in the jig is shown in Fig. 3 and a complete set with the exception of the two covering cores is shown in Fig. 4. A complete core assembly transferred from the setting-up to the suspension jig and on its way into the mold is shown in Fig. 2.

The casting is molded and poured in the op-

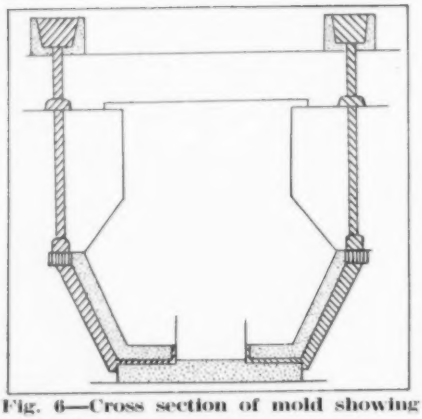


Fig. 6—Cross section of mold showing basin, sprue, runners and gates

posite position to that it occupies in service, that is with the flange of the crankcase in the cope and the face to which the cylinder heads later are bolted, in the drag. This feature is illustrated in Fig. 5 (one of the castings) which also shows the general design of the brackets and bearings inside the crankcase. In this connection it is interesting to note that the large core forming the inside of the crankcase is of compound construction. Comparatively thin cores are made first, carrying impressions of the brackets and bearings. These thin cores then are placed in proper position in the large corebox where they become an integral part of the large block core. Each of the thin cores is suitably marked and a corresponding mark on the main corebox guides it into place.

Build up Crankcase Core

The foregoing is a typical example of how corebox construction is simplified without any sacrifice in ultimate assembling or accuracy. In fact the one-piece crankcase core containing cavities to form the brackets and bearings, is a much more solid, substantial piece of construction, than a possible alternate made up of three sections with the ends butted together.

The assembly jig shown in Figs. 3 and 4 is a substantial iron casting mounted on four legs at a convenient height for the operator to set the cores. The inner surface is machined accurately, a replica of the surface of the drag mold. Three pins on one joint surface and one pin on the other indicate the right and left sides and prevent any possibility of the cores being assembled *end for end*. They also insure the proper location of the upper or suspension jig which later is employed to lower the core assembly into the mold. The end frame shown in Fig. 3 is an aluminum casting guided into place by suitable pins and held there by swinging bolts and wing nuts at the three points of the triangle.

Short double end or stud chaplets are employed extensively to supplement the core prints and insure rigidity of the entire structure. Many of the interior cores are surrounded almost entirely by metal when the casting is poured. Also, the entire structure is built up successively from the bottom, hence the necessity of the chaplets to support the load of the upper cores. Ingenious construction of the core prints in many instances serve to lock these cores automatically and securely in place.

This feature in connection with the barrel cores may be noted in Fig. 1 where the 12 barrel cores for one casting are shown in the middle foreground. The group of six on the right are arranged to show the drag prints, while the upper or cope prints are shown on the group of six at the left. Sand for these cores is rammed by hand in a single box. The cores are dried horizontally in dryer shells. The vent escapes through the drag print. The taper print at the bottom guides the (*Please turn to page* 51)

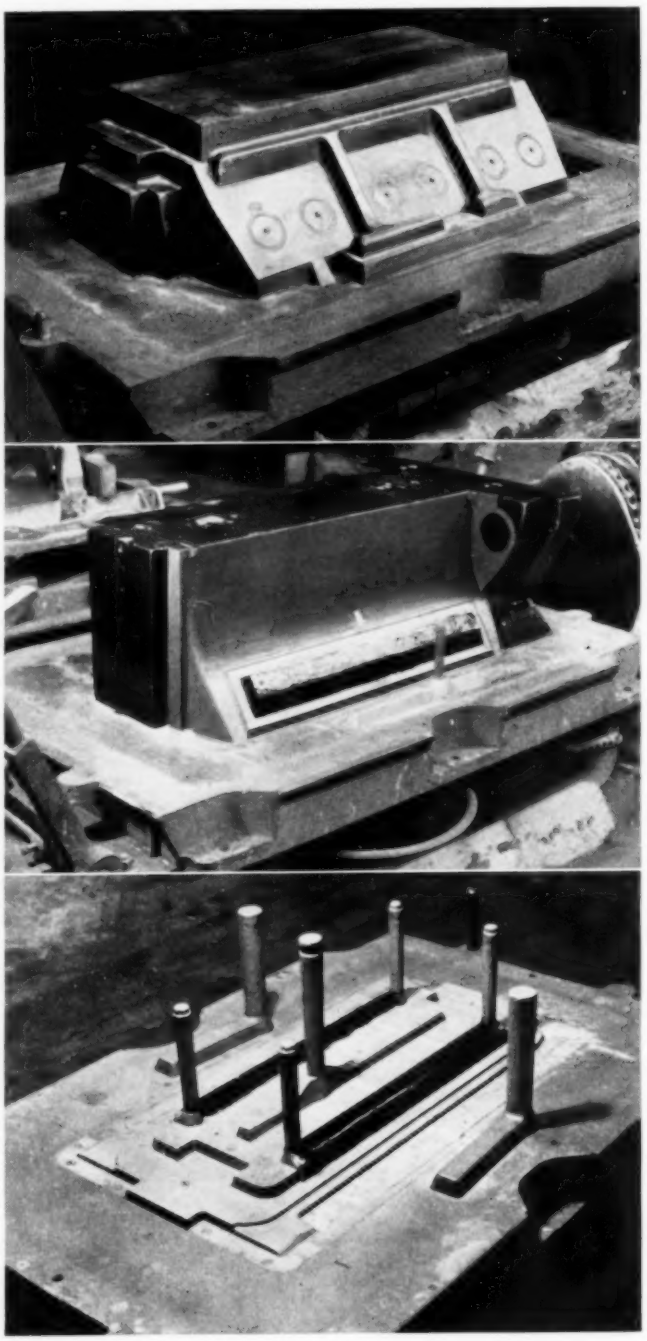


Fig. 7 (Above)—The drag pattern is enclosed in core prints with bottom runners attached. Fig. 8 (Center)—Loose core prints at the ends are drawn before the cheek is lifted. Fig. 9 (Bottom)—The cope pattern is almost a flat plate with runners and vent standards in place

I. B. F. Features Alloys in Iron

Thirtieth annual meeting is held in Cardiff, home of incoming president of organization

By VINCENT DELPORT
European Manager, The Foundry

CARDIFF, scene of the thirtieth annual conference of the Institute of British Foundrymen from June 20 to 23, is the home of the incoming president of that organization, C. Edward Williams, foundry proprietor and one of the leading industrialists of South Wales. The conference was well attended and an exceptional program was provided.

Tuesday evening, June 20, the delegates of the conference were offered a civic reception at the city hall by the Lord Mayor and Lady Mayoress. The banquet was held on Wednesday evening, and also was attended by the Lord Mayor and Lady Mayoress. On Thursday evening, a reception was held at the university at the invitation of the principal of the University college of South Wales and Monmouthshire. Friday was devoted to a tour through some of the most beautiful scenery of Glamorgan, Monmouthshire and Gloucestershire, and included Usk, the Wye Valley, and Tintern Abbey. In the course of the tour a number of Roman ruins and other points of historic interest were visited.

C. Edward Williams
President-elect, Institute of British Foundrymen

The conference opened on Wednesday morning June 21, with a civic welcome by the Lord Mayor of Cardiff, supported by J. F. Rees, principal of the University College of South Wales and Monmouthshire. Victor Stobie, president of the institute, was in the chair. The Oliver Stubbs medal was awarded to J. W. Gardom in recognition of his outstanding work during the past year in the interests of the institute, more particularly as convenor of the technical committee.

A new award, made for the first time this year, for meritorious service on the part of a member of the Institute over a number of years was presented to F. W. Finch, who is 87 years of age and who is one of the original members who founded the institute in 1904. This award is in the form of a medal, which will be given, as opportunity arises, to a member who in the course of his association with the institute has rendered outstanding service.

The report on the activities of the institute for the year 1932-1933 showed 1894 members on the roll on April 30. It was mentioned in the report that it had been proposed to inaugurate a degree course in founding at the University of Sheffield, and it is confidently expected that this proposal will materialize shortly, to the great benefit of the foundry industry. The following officers were elected: President, C. Edward Williams, chairman, John Williams & Sons (Cardiff), Ltd., Cardiff; senior vice president: Roy W. Stubbs, Joseph Stubbs, Ltd., Manchester; junior vice president: J. E. Hurst, Sheepbridge Stokes Centrifugal Castings, Ltd., Chesterfield.

Mr. Williams, in the presidential address, reviewed the origin, development and progress of the foundry industry since the early ages. He emphasized that without the art of founding, civilization never would have reached its present stage. In fact, the foundry industry is one of the bases on which rests present-day civilization. The art of founding is not only responsible for the material development of mankind, but also holds a high place in the field of artistic development.

The first paper, "Mechanized Foundries," by F. J. Cook, past-president of the institute; was illustrated by films showing numerous modern foundries in Great Britain. Opening the discussion and referring to the cupola plant, A. S. Beech said that he is in favor of the Ronceray brick method of dis- (*Please turn to page* 45)

Move Toward Industrial Codes

Four branches of industry form council to consolidate interests and make adjustments

THOROUGHLY aroused and with a unanimous desire to co-operate to the fullest extent in the administration's effort toward industrial recovery, the foundry industry is moving fast. The four groups of castings manufacturing foundries comprising within their scope the entire industry and embracing under the gray iron, steel, malleable and nonferrous classifications more than 5200 foundries are cooperating. They are definitely committed to the principle that the plan of organization and the entire scope of the National Industrial Recovery act contemplates an integration upon the basis of process classification.

Steel Foundries Prepare Code

STEEL—The Steel Founders' Society of America has been designated as the source through which all action will be taken under the National Industrial Recovery act. Subsequent to a meeting in Chicago previously reported, a reorganization was effected whereby the Steel Founders' society became an unincorporated organization. At the meeting held in Cleveland, Aug. 4, representatives of a preponderance of the steel foundry industry adopted a new constitution and by-laws and approved a code for submission to Washington under the N. I. R. A., the presentation to be made Wednesday, Aug. 9.

Under the new constitution and by-laws eight geographical districts are established. Each steel foundry interest will possess Class A and Class B votes. The Class A vote is designated as only one for each firm while the Class B votes will be determined upon a unit division of the annual dues, while the dues in turn are based upon the basis of each member's monthly average of the best six consecutive months' shipments preceding the fixing of the annual budget.

In this manner companies having a number of plants possess only one Class A vote, but multiple Class B votes and the latter are assigned to the districts in which the respective plants are located. Each district will elect one director and one or more alternates to serve for a term of 1 year. At present the district chairmen composing the board of directors of the Steel Founders society are as follows:

Division No. 1—Harrison Hoblitzelle, General Steel Castings Corp., Eddystone, Pa.; Division No. 2—Keith Williams, Pratt & Letchworth Co., Buffalo, N. Y.; Division No. 3—J. W. Glover, Glover Machine Works, Marietta, Ga.; Division 4—D. C. Bakewell, Duquesne Steel Foundry division of Continental Roll & Steel Foundry Co., Pittsburgh; Division 5—E. L. Brooks, Sawbrook Steel Castings Co., Lockland, Cincinnati; Division 6—F. A. Lorenz, Jr., American Steel Foundries, Chicago; Division 7—A. O. Woerner, Scullin Steel Co., St. Louis; Division 8—R. E. Noack, Monarch Foundry & Engineering Corp., Ltd., Stockton, Cal.

T. H. Harvey, Ohio Steel Foundry Co., Lima, O., is president of the society, Col. Merrill G. Baker is executive vice president and R. L. Collier, secretary-treasurer.

The code as adopted by the Steel Founders' society presents a basic 40-hour week. A series of wage districts covering 23 areas based upon geographical location and having in consideration municipal areas is established and the minimum basic wage rate covers gradations from 30 cents an hour in four southern sections to 40 cents an hour in industrial regions, and applicable to general labor. The differential set forth is determined carefully upon accurate surveys of prevailing wage and living costs in the districts in the past. The spread between general labor and all other classes of employes will not be affected. Administration of the code is assigned to the board of directors with authority to provide suitable administering machinery.

Forms Gray Iron Steering Committee

GRAY IRON—Organization of the broad industry committee of the gray iron industry has been affected and full powers delegated to a steering committee composed of the following: Walter L. Seelbach, Forest City Foundries, Cleveland, chairman; Frank A. Hoadley, Farrell-Birmingham Co., Ansonia, Conn.; C. D. Cabaniss, Columbus Iron Works Co., Columbus, Ga.; A. H. Kramer, Advance Foundry Co., Dayton, O.; C. B. Magrath, Northwestern Foundry Co., Chicago; and William T. Mellow, Liberty Foundry Co., St. Louis. This steering committee has prepared a

complete code subject to approval by the 17 districts embracing all of the United States. These district meetings are being held and will be completed in time for submission of the code prior to Sept. 1. The various districts and representatives chosen in the gray iron industry are as follows:

Connecticut—Franklin R. Hoadley; Henry S. Washburn, Plainville Castings Co., Plainville, Conn. Northern New England—G. A. Sweet, Milford Iron Co., Milford, Mass.; A. B. Root, Hunt-Spiller Mfg. Co., Boston. New Jersey—John L. Carter, 92 Elm street, Montclair, N. J.; David Macintosh, Sacks-Barlow Foundries Inc., 357 Wilson avenue, Newark, N. J. Metropolitan New York—Andrew N. Petersen, Brooklyn Foundry Co., Astoria, N. Y. Western New York—R. E. Dillon, Lake Erie Engineering Corp., Buffalo; Henry D. Miles, Buffalo Foundry & Machine Co., Buffalo. Western Pennsylvania—H. P. Spilker, Sterrit-Thomas Foundry Co., Pittsburgh; C. Howard Paul, Mackintosh-Hemphill Co., Point building, Pittsburgh. Eastern Pennsylvania—B. H. Johnson, R. D. Wood & Co., Philadelphia; N. H. Schwenk, Cramps Brass & Iron Foundries Co., Paschall station, Philadelphia. Northern Ohio—W. L. Seelbach; C. M. Bolich, Nickel Plate Foundry Co., Cleveland. Southern Ohio—A. H. Kramer; George Seyler, Lunkenheimer Co., Cincinnati. Southern States—C. D. Cabaniss; W. F. Tynes, Hardie Tynes Mfg. Co., Birmingham, Ala. Michigan—Fred Erb, Eaton-Erb Foundry Co., Detroit; Hugh Martin, Detroit Gray Iron Foundry Co., 6403 Wight street, Detroit. Northern Illinois—C. B. Magrath; R. D. Phelps, Francis & Nygren Foundry Co., Chicago. Quad Cities—John Diedrich, Blackhawk Foundry & Machine Co., Davenport, Iowa; W. E. Robinson, Hedford Bros. & Hitchins, Waterloo, Iowa. St. Louis—Wm. T. Mellow. Wisconsin—W. J. Grede, Liberty Foundry, Inc., Wauwatosa, Wis.; W. R. Tanner, Zenith Foundry Co., West Allis, Wis. Minnesota—J. F. Quest, Jeffery-Quest Foundry Co., Minneapolis; Stewart Cameron, Valley Foundry Co., St. Paul. Pacific Northwest—Ronald E. Kucher, Olympic Foundry Co., Seattle.

Compile Statistics on Industry

Statistics are being compiled at the request of the steering committee, through the offices of THE FOUNDRY and these statistics will be utilized to support the code when submitted. Opportunity is given under the committee arrangement for participation of members of the Gray Iron institute, nonmembers and those foundries which manufacture gray iron castings for their own use. An equitable determination of dues or fees under this joint and yet diverse interest has been arranged.

MALLEABLE—At a meeting of the malleable industry of the United States held in Cleveland, July 31, a new organization known as the Malleable Founders' society was established. The society has been vested with full authority by the industry to represent all malleable foundries under the National Industrial Recovery act. A code embodying minimum hours of labor made necessary by the continuous character of operation in producing malleable castings and with a variable scale of wages fully in accord with the spirit of the N. I. R. A. was adopted and soon will be submitted for approval.

Elect Twelve Directors

The Malleable Founders' society will be governed by a board of directors of 12 and the committee of 12 previously elected to represent the three sections, eastern, central and midwestern was unanimously elected to serve until the annual meeting in 1934. The board of directors is as follows:

Western District—L. M. Eyke, president, Terre Haute Malleable & Mfg. Co., Terre Haute, Ind.; E. E. Griest, vice president, Chicago Railway Equipment Co., Chicago; R. R. Fauntleroy, president, Moline Malleable Iron Co., St. Charles, Ill.; J. G. Malnoski, general manager, Muncie Malleable Foundry Co., Muncie, Ind.

Central District—John C. Haswell, president, Dayton Malleable Iron Co., Dayton, O.; A. F. Jackson, vice president, Michigan Malleable Iron Co., Detroit; Carl C. Gibbs, assistant to president, National Malleable & Steel Castings Co., Cleveland; R. N. Cole, president Canton Malleable Iron Co., Canton, O.

Eastern District—C. L. Berger, president, Eastern Malleable Iron Co., Naugatuck, Conn.; H. L. Steeves, vice president and general manager, Rhode Island Malleable Iron Works, Hillsgrove, R. I.; T. F. Hammer, vice president, Malleable Iron Fittings Co., Branford, Conn.; P. R. VanDuyne, president, Meeker Foundry Co., Newark, N. J.

R. R. Fauntleroy was elected president and Robert E. Belt was chosen as secretary of the new organization.

NONFERROUS—Following the formation of the Nonferrous Foundry Association for Industrial Recovery, as reported elsewhere in this issue, a tentative code for the industry has been prepared. The organization contemplates wage and labor sections reconciled in large measure with the gray iron foundry industry inasmuch as the geographical distribution of malleable and gray iron foundries closely paralleling a wage structure taking into account both geographical areas and large centers of population has been tentatively accepted.

Co-operative action between the trade associations representing the four branches of the foundry industry was assured through a conference held in Cleveland, Thursday, August 3. At the invitation of Walter (*Please turn to page* 42)

Phosphorus in Cast Iron—I

Lowers freezing point, affects carbon pickup and does not materially effect tensile strength

By JOHN W. BOLTON

Lunkenheimer Co., Cincinnati

ABOUT 1669, one of the last of the alchemists, Hennig Brand, first produced some of the strange phosphorescent element called phosphorus. In 1771 Scheele described the production of phosphorus from the calcium phosphate found in bone ash. The element phosphorus has an atomic weight of 31.04. It can exist in two allotropic forms, white phosphorus and red phosphorus.

Phosphorus is found in ferrous metals as iron phosphide (Fe_3P). The phosphorus content is derived from calcium phosphate and other phosphates found in iron ores. Since practically all the phosphorus in the ore is retained in the pig iron it is evident that high phosphorus ore will produce high phosphorus pig irons and vice versa. To get low phosphorus pig iron it is necessary to use low phosphorus ore. However, high phosphorus iron can be made from low phosphorus ore. This is accomplished by adding phosphate rock or the equivalent to the furnace burden.

Phosphorus is an undesirable impurity in most steels. Basic steel making processes, employing basic open hearth or basic electric furnaces are able to eliminate much of the phosphorus from the pig and stock charged. These basic melting processes can make use of higher phosphorus pig iron, and for this reason higher phosphorus pig iron with silicon under 1 per cent commonly is called basic iron.

Acid bessemer, acid open hearth and crucible processes are unable to reduce phosphorus in the charge. Therefore, these processes can use only lower phosphorus pig irons. Such low phosphorus irons with silicon 1 to 1.5 per cent and phosphorus under 0.10 per cent are known to the trade as bessemer.

Line Not Drawn Tightly

Thus the two great grouping of pig irons, basic and bessemer, depend on the phosphorus and silicon content of the irons. The bessemer grades are low phosphorus and the higher phosphorus grades are known as basic.

The line of demarcation for foundry irons formerly was drawn sharply. Irons under 0.30 per cent phosphorus were not considered proper for foundry use. Today, irons under 0.30 per cent phosphorus are used widely so that both bes-

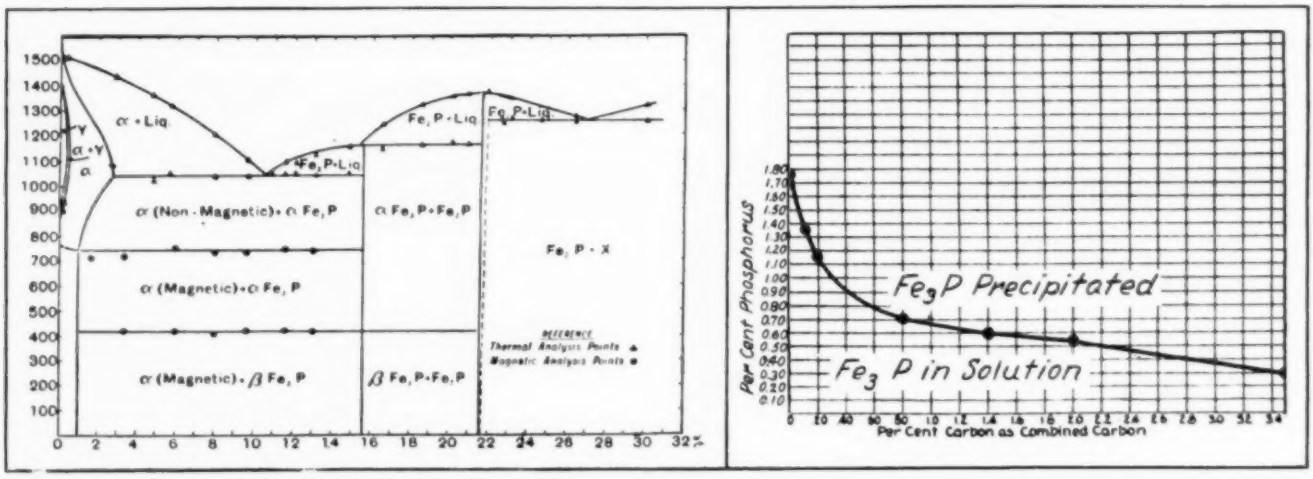

α + Liq
Fe, P + Liq
α + γ
α
α (Non-Magnetic) + α Fe, P
α Fe, P + Fe, P
Fe, P + X
α (Magnetic) + α Fe, P
α (Magnetic) + β Fe, P
β Fe, P + Fe, P
Thermal Analysis Points
Magnetic Analysis Points
Per Cent Phosphorus
Fe3P Precipitated
Fe3P in Solution
Per Cent Carbon as Combined Carbon

Fig. 1 (Left)—The iron phosphorus diagram as developed by Haughton. Fig. 2 (Right)—Effect of carbon on the solubility of phosphorus is shown in this diagram which is plotted from Stead's data

semer and acid open-hearth irons are finding practical foundry use.

In cupola melting, the percentage of phosphorus in the molten metal is practically the same as the amount charged. As cupola atmospheres are not strongly reducing, small amounts of phosphates in the fluxes and coke ash do not add to the phosphorus in the iron. However, the percentage of phosphorus in the mixture usually is slightly higher than that calculated from the charge.

The reason for this is that no phosphorus is lost, while some of the iron, manganese and silicon are removed by oxidation. The trend of quality irons today is toward the lower phosphorus metals. Foundrymen have found that proper melting practice will give enough fluidity without using high phosphorus irons, as will be explained more fully later.

Stead's Work Is Classic

The iron phosphorus diagram of Haughton (*Journal* Iron & Steel institute, 1927) is shown in Fig. 1. This work followed a series of researches conducted by various workers, among the more notable being those of Stead, Wust and Satlakwalla. Stead's systematic papers on phosphorus are among the classics of metallurgical literature, and it may be said that he laid the foundation for most of our modern knowledge of the structural formations of iron and phosphorus.

Stead showed that iron and iron phosphide at first form a series of solid solutions, up to somewhat above 1 per cent phosphorus, usually given as 1.7 per cent. Various investigators have shown that these iron-iron phosphide solid solutions are slightly stronger and harder, and are considerably less ductile than pure iron or ferrite.

In irons above 1.7 per cent phosphorus, a new cellular component makes its appearance and at 10.2 per cent phosphorus the material consists entirely of an eutectic cellular structure. As was established by Stead this substance consists of an eutectic of iron, (with iron phosphide in solid solution), and iron phosphide. According to the diagram of Haughton the melting point of this eutectic is about 1860 degrees Fahr. although Stead and other early investigators generally give it as about 1800 degrees Fahr. The composition of this eutectic is 61 per cent iron phosphide (Fe_3P) and 39 per cent of iron (with iron phosphide in saturated solid solution). It is a hard and brittle substance.

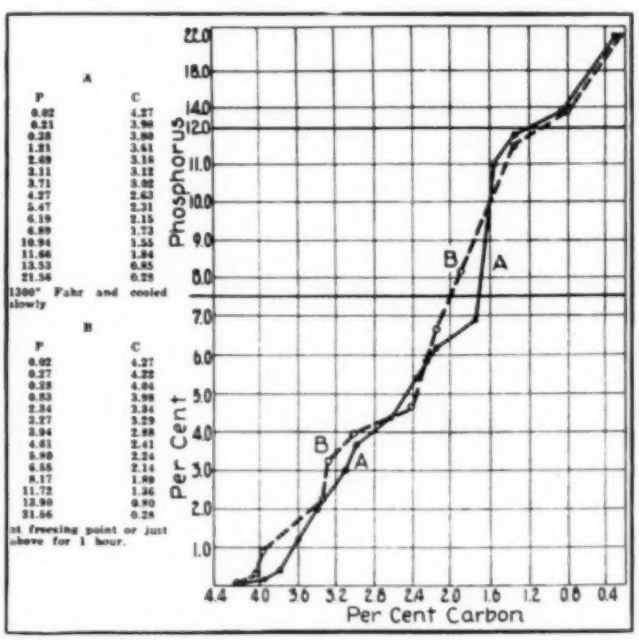


Fig. 3—Wust's results on the effect of phosphorus on carbon

Includes Original Research On Phosphorus in Iron

FOR many years, the subject of phosphorus in cast iron has attracted considerable attention from various investigators. Seven years ago, in the May 15 and June 1, 1926, issues of THE FOUNDRY, an article by John W. Bolton, the present author, entitled "Phosphorus Affects Quality of Gray Cast Iron," reviewed the effect of phosphorus in some detail. Since that time, a number of carefully conducted researches have added to the available knowledge on the subject. Since this information is widely scattered, it has not all been available to many foundrymen.

The present articles have been prepared with the idea of bringing the subject up to date. The author has included some hitherto unpublished research data which, it is hoped, will clarify the knowledge of the precise mechanism involved in the change from ternary iron-phosphorus-carbon forms, to binary iron-phosphorus forms most commonly found in gray irons.

The author is metallurgist, the Lunkenheimer Co., Cincinnati, and is the consultant on gray iron problems on the editorial advisory staff of THE FOUNDRY.

Is Free Iron Phosphide

Beyond 10.2 per cent phosphorus a new component (shown as diamond shaped crystals) makes its appearance. This substance is free iron phosphide Fe_3P. At about 15.6 per cent phosphorus the material is completely or 100 per cent iron phosphide. Iron phosphide crystallizes in the tetragonal system. Spencer, in the *Journal*, Iron and Steel institute 1918 and Le Chatelier and Wologdine, *Comptes Rendus* 1909 give its specific gravity as 6.74. Nickel and phosphorus also form a phosphide, Ni_3P, which is soluble in Fe_3P, and like Fe_3P also is somewhat soluble in iron.

If carbon is added to a saturated solid solution of Fe_3P in iron, some of the phosphide is thrown out of solution. This was shown first by Stead, and his test results are shown diagram-

matically in Fig. 2. Conversely, if phosphorus is added to an iron of eutectic composition, both the melting point of the alloys and the carbon content of the eutectic are lowered. This was shown clearly by Wust. His tabular data on effect of carbon concentration and diagram constructed therefrom are shown in Fig. 3. The effect on melting point is shown in Fig. 4.

Both Stead and Wust found a ternary eutectic of iron phosphorus and carbon, that is iron, iron carbide, and iron phosphide. As long ago as 1875 Stead demonstrated the existence of this fusible component in an interesting manner. He squeezed high phosphorus material, a sample of Cleveland (high phosphorus) pig iron, just after its apparent complete solidification. "Sweating" of small beads or pellets of phosphorus rich material from chilled rolls has been described by A. Allison in *The Metallurgist*, Jan. 27, 1928, and similar segregations have been noted by others.

Lowers Melting Point

The iron carbide (Fe_3C)—iron phosphide (Fe_3P) section of the ternary diagram was shown by Vogel, *Archiv fur Eisenhuttenwesen*, November, 1929. He found that the ternary eutectic contains 8.0 per cent phosphorus and 3.2 per cent carbon. This is somewhat at variance with the results of earlier investgators who found it contained about 6.7 per cent phosphorus and 2.0 per cent carbon. It freezes at 1773 degrees Fahr.

Reference has been made to the effect of phosphorus in lowering the melting point of the iron carbon eutectic. Wust's work showed that this lowering of initial freezing point is nearly 50 degrees Fahr., or more exactly, 48.6 degrees Fahr. for each per cent of phosphorus present. Furthermore, the metal freezes over a range of temperature, as much as 220 degrees Fahr. in presence of 1 per cent of phosphorus. All investigators agree that phosphorus does not affect the austenite-pearlitic transformation temperature much.

These effects of phosphorus on critical points have been shown in rather clear fashion by Coe, whose cooling curves of cast iron samples with various phosphorus contents (ranging from 0.09 to 2.90 per cent) are shown in Fig. 5. It will be noted that the *inital* and *eutectic* freezing points are lowered with increasing phosphorus. The phosphide eutectic point becomes more *intense*, and the austenite-pearlite transformation point remains practically constant.

Forms Binary Eutectic

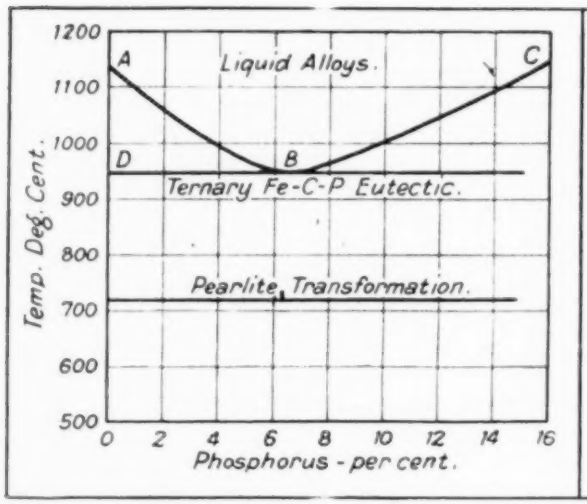
So far only alloys of iron and phosphorus, and of iron phosphorus and carbon have been considered. The high carbon alloys considered were white irons. What happens when sufficient silicon is present for graphitizaton to occur? Stead found that in gray cast irons the phosphide exists largely as a *binary* eutectic containing 10.2 per cent phosphorus and 89.8 per cent iron. This phosphorus rich component aptly is termed *steadite* in honor of the brilliant investigator.

Various workers agree that phosphorus has little effect on graphitization. It hinders graphitizaton slightly. We now are ready to proceed with the discussion of the effects of phosphorus and its distribution in commercial gray irons.

Influence On Properties

(a) An increase in phosphorus lowers the freezing points of commercial cast irons. This and the fact that solidification occurs over a range of temperature, results in the following effects:

High phosphorus irons run or flow better, at a given temperature, than low phosphorus irons of otherwise equivalent composition. This has been shown by Sarto and Hayashi, memorandum of college of engineering, Koyto Imperial university, July, 1924 and (*Please turn to page* 48)



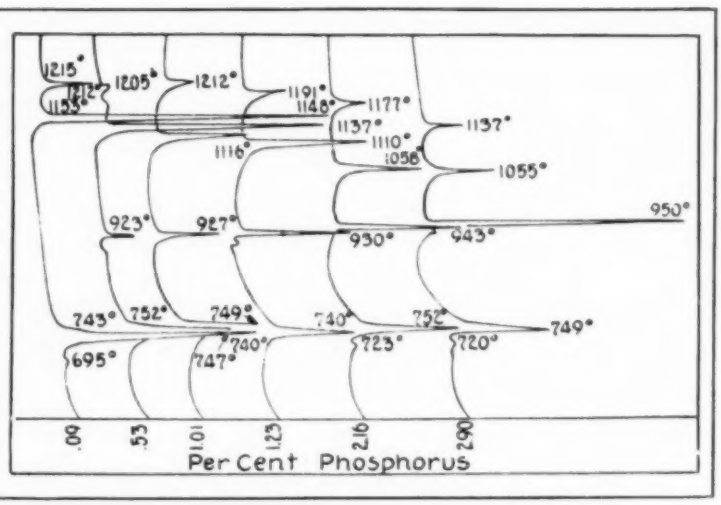


Fig. 4 (Left)—Effect of phosphorus on the melting point, according to Wust. Fig. 5 (Right)—Cooling curves of cast iron samples containing increasing percentages of phosphorus

Cast Steel in Europe and America

Naval officer visits foundries in England and on the Continent and compares practice

By PAT DWYER

WHEN limitations of weight became an important factor in the existing exacting specifications governing the acceptance of steel castings, the navy department of the United States decided to conduct an investigation with a view of finding a solution for the problem of how to produce perfect castings. As a preliminary step Capt. Louis Shane, a naval officer familiar with American steel foundry practice was directed to visit European steel foundries and report on methods, materials and products.

A review of his findings followed by discussion by Commander E. D. Almy, Dr. R. H. Canfield and C. W. Briggs, naval research laboratory, Anacostia, D. C.; George Batty, Steel Founders Development bureau; P. E. McKinney, Bethlehem Steel Co.; Jerome Strauss, Vanadium Corp. of America, and J. E. Crown, Naval Gun Factory, Washington, appeared in the February, 1933 issue of the *Journal of the American Society of Naval Engineers*. Further discussion by R. A. Bull, Electric Steel Founders Research group; J. E. Burkhardt, Bethlehem Shipbuilding Corp.; and K. D. Williams, navy department, was published in the May, 1933 issue of the same publication.

Presents Impressions of 38 Foundries

With the exception of one or two items, Captain Shane refrains from comment or from drawing comparisons between steel foundry practice on the east and west sides of the Atlantic. He presents a description of what he saw and heard in 38 representative steel casting plants in Belgium, Czecho-Slovakia, England, France, Germany, Holland, Italy, Poland, Scotland and Switzerland.

Instancing the recent failure of certain scout cruiser stern parts Captain Shane claimed that American steel foundries practice welding to an unwarranted extent. He saw little or no welding abroad even on the largest and most complicated castings. The British Admiralty absolutely refuses to accept any casting in which even a minor flaw or imperfection has been repaired by welding. Many European foundrymen hold to the opinion that the melting process is hurried too much in America and that in many instances the metal is raised to an unnecessarily high temperature, even though later it may be poured at a considerably lower temperature. Both these factors are inimical to the production of satisfactory steel castings.

He found that differences in technique varied almost as widely as the number of foundries, but that the methods in all successful foundries are basically similar. Great attention is paid to the fluidity of the metal. A preference is shown for the higher carbon steels, partly on account of the higher physical properties, but principally because adequate fluidity is obtained at a lower temperature. For low carbon steels and for thin sections an exceedingly high temperature is necessary, but this is regarded as one of the unavoidable hazards of the steel foundry industry.

Internal Chills Used Extensively

No hard and fast rule was found covering the alternative use of internal chills and large risers. At one foundry near Lille, France, no chills are employed, but shrinkage is prevented by immense risers that exceed the weight of the casting by 300 to 400 per cent. At a second foundry in the same district the risers are held to a nominal size, but horse shoe nails are employed profusely as internal chills. The management claimed that the nail heads fuse with the metal and that the resulting casting is homogenous.

In European foundry practice the average weight of the riser is about 80 per cent that of the casting. Almost invariably cores in the castings are hollow and filled with coke or cinders. Walls are quite thin. With few exceptions European foundries produce excellent castings and in Captain Shane's opinion the principal reason for this is that they are scientifically operated by expert engineers.

The Captain found that usually the foundryman makes the patterns. Where his specialized knowledge shows him that a certain design can

not be reproduced as a steel casting, he can consult the customer with a view of bringing the design within manufacturing limits. Foundry draftsmen go over the design and in consultation with the master molder and other experts determine location and size of risers and gates, also the location and character of chills, if any. Metal melting is under direct supervision of a metallurgist. Heat treatment also is under his charge.

In continental European foundries the converter no longer is regarded with favor, but many English foundrymen still prefer this method of steel melting. At one British plant visited the test record of a 0.35 per cent carbon steel showed the following excellent physical properties: Tensile strength 38 tons, yield point 21 tons, elongation 28 per cent in 2 inches, reduction in area 39 per cent, bent test 180 degrees around 1-inch bar. For a given temperture converter metal is more fluid than metal produced either in the electric furnace or open hearth.

Anneal All Steel Castings

In European steel foundries every casting is annealed at least once, but the practice and temperatures vary to a considerable extent depending on the carbon content and the character of the alloys, if any. Annealing temperatures range between 840 degrees Cent. (1546 Fahr.) and 950 degrees Cent. (1742 Fahr.) for carbon steels and between 1000 and 1050 degrees Cent. (1832 and 1912 Fahr.) for corrosion resistant steels.

Captain Shane pointed out that the best foundry sand is found in northern France and Belgium. Various combinations are made up in other countries with the basic idea of utilizing as much local sand as possible. In one Czecho-Slovakian foundry visited 25 different sand mixtures were used. Sand control methods are similar to those practiced in American foundries and a large part of the sand testing equipment is of American manufacture.

In the majority of continental European foundries visited a mixture known as *chamotte* is used for facing the molds. A somewhat similar mixture known as *compo* is used in British foundries. Chamotte is a clay roasted at a high temperature resulting in a very refractory product. The roasted clay is ground to the required fineness and mixed with green clay binder in the proportion of 6 parts chamotte to 1 part clay. Ground to a fine powder it is used as a mold wash.

A peculiar sand mixture in one French foundry is made up of 1100 kilograms (2413 pounds) chamotte; 550 kilograms (1207 pounds) 25 per cent silica sand; 30 kilograms (66 pounds) coal tar; 80 liters (21 gals) water. Old sand with an addition of 10 per cent clay serves as backing sand. Worn out crucibles are ground and used for facing sand in places where crucible melting is practiced.

Oil and dextrin bonds either singly or in combination are used in core sand mixtures. In the foundries inspected in northern France and Belgium ordinary sand is used for both molds and cores except in special cases where difficulty is experienced in extracting the core rods. For a particularly intricate jacket core, silica sand and brown lignite bonded with black oil are used in one German foundry. Ordinary sand or chamotte cores are bonded with a proprietary material or with a by product liquid from wood pulp.

Facing sand used extensively in the English foundries inspected is made up of silica sand and Yorkshire sand, 36 parts of the first to 9 parts of the second. The Yorkshire sand is a natural mixture 50 per cent silica and 50 per cent clay.

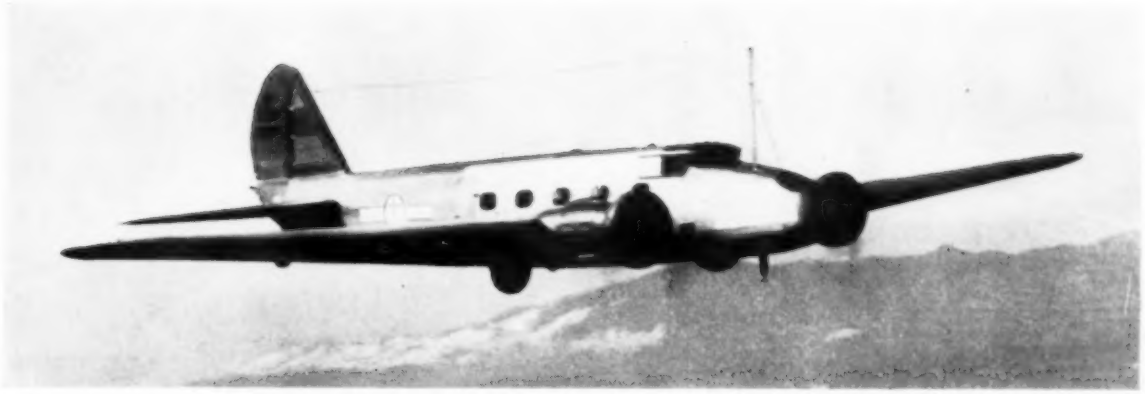
At a German foundry Captain Shane noted a diesel engine bed plate with five bearings for four crankshafts. The casting was surmounted with 20 risers, four on each bearing, two on the outer edge abreast the bearing and two on the inner edge of the bearing. A small casting weighing about 60 pounds was supplied with 17 risers, one over each part where a draw possibly might appear.

He was surprised at a peculiar performance in a foundry in Feignies, France, where two barrels of water were upset over the risers of a large casting immediately after the ladle was removed. He was told that the metal sets in a few seconds and the feeding was finished. Later upon inquiry this point was confirmed at the naval research laboratory where tests have been made to determine the setting time.

Castings Poured in Core Assemblies

At one plant in the French Alps steel castings are produced in a cement bonded silica sand which requires neither flasks nor drying ovens. The mold parts are rammed up in core-boxes and afterward assembled. Several advantages are claimed for the method, but British foundrymen claim that the high license fee renders it prohibitive on their side of the channel.

With the exception of baths for cleaning corrosion resisting steel castings, the pickling method is not employed to any great extent. This fact rather confirms Captain Shane's opinion that pickling of ordinary steel castings is highly undesirable, despite the fact that the British Admiralty specifications call for pickling all castings to be used with steam. A variation was noted in the method of introducing deoxidizing agents to the molten metal. Ferrosilicon and ferromanganese may be introduced either in the furnace or in the ladle. Usually the aluminum, 500 grams (1 1/10 pounds) per ton is introduced into the ladle. Some plants which (*Please turn to page* 49)



One of the new three-mile-a-minute planes which uses 183 castings

Castings Speed Transport Planes

Sixty new passenger ships each use 183 cast parts to provide strength and safety

By R. E. JOHNSON
United Air Lines, Chicago

NEW high-speed transport planes of the United Air Lines, capable of traveling three miles a minute, are writing a new chapter in the history of aircraft design and construction. The planes are of metal construction except for a small amount of plywood used in the cabin insulation and flooring; they are equipped with two 550-horsepower supercharged Wasp motors and have a cruising speed of 171 miles an hour while carrying ten passengers, their baggage, two pilots, a stewardess and cargo. Sixty of these 1933 carriers being produced by the Boeing Airplane Co., Seattle, are slashing travel time by hours.

Strength, high performance, passenger comfort and operating economy are outstanding characteristics of the twin-engined monoplanes, and castings, light but strong, are a very definite part of their all-metal construction. A total of 183 castings is being used in each of the 60 planes under construction. They are employed in a variety of places for a variety of purposes.

The largest use of castings is in connection with control parts, such as flight controls, landing gear controls and power plant controls. For the most part, they are of aluminum alloys, although steel and bronze castings also have their place in the plane.

Castings generally are preferred over fabricated steel fittings because of their lower cost and their superior rigidity, particularly where gears are involved. At the same time, they are easily machined as required for alignment with the supporting structure.

In the days of *stick and wire* type planes, as well as in those of internal steel structures, welded or brazed steel fittings and assemblies were employed by the Boeing company. Castings came into more extended use with complicated airplane designs, calling for certain fittings and assemblies which could not be welded to obtain comparable weights. Aluminum alloys also had come to replace steel for the internal structures of Boeing planes and the use of aluminum alloy castings meant elimination of the problem of corrosion caused when dissimilar metals come in contact. At the same time, aluminum alloys can be cast into complicated curves and designs which would be virtually impossible and definitely impractical to attempt through forming sheet and bar stock.

Present Larger Bearing Area

Not only does the aluminum alloy casting, by reason of the greater mass represented, provide superior rigidity than that possible with welded steel fittings but it also presents a larger bearing area.

All castings used by the Boeing company are purchased, since it has been found that this method is more economical than manufacturing them in the plant.

Small Cupola Handles Rush Jobs

On a 12-inch diameter lining this baby furnace melts about 1000 pounds per hour

By E. S. ENSIGN

Ensign Foundry Co., Toledo, O.

GRAY iron foundrymen confronted occasionally with the problem of melting a few hundred pounds of iron for a rush job or as an accommodation to a customer, will be interested in the construction and operation of a small 12-inch cupola which has been rendering admirable service at the plant of the Ensign Foundry Co., Toledo, O. One man attends to all the work including charging and tapping. Under normal conditions this cupola will melt 1000 pounds per hour. Under stress this amount has been increased to 1200 pounds, but this rapid melting is hard on the lining and is not recommended.

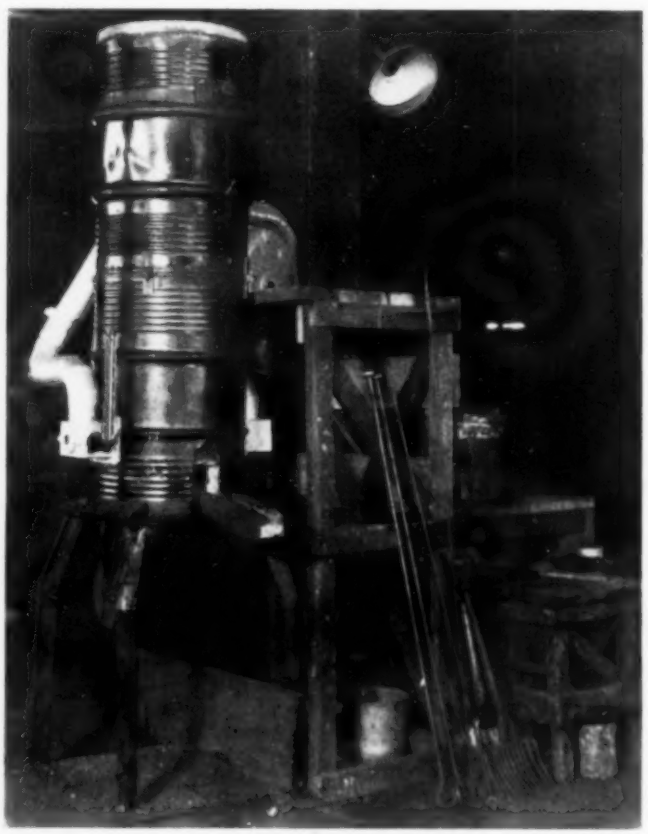
The shell of this baby cupola is made up of two ordinary steel oil drums, one on top of the other and held together by four small cast iron angles and bolts. By removing four bolts the upper drum may be removed, thus affording easy access and facilitating renewal of the lining. A cast iron ring at the joint and bolted to the upper drum holds the lining in place when the upper drum is raised. However, up to the present no necessity has been found for lifting the upper drum. All the patching has been accomplished through the opening in the bottom.

Use Two Iron Wind Boxes

Two cast iron wind boxes are bolted to diametrically opposite points on the shell. Size of each tuyere opening in the shell is 2¼ x 3 inches, which is increased to 2¼ x 4 inches at the inner end of the tuyere. Combined area of both tuyeres is 18 inches, or a ratio of 1 to 6.4 compared to the cross sectional area of the cupola. The bottom line of the tuyeres is 8 inches above the bottom plate and 6 inches above a 2-inch sand bed. The hearth or crucible of the cupola holds about 100 pounds of iron and is filled every 6 or 7 minutes when the cupola is melting properly.

Branch pipes from the two windboxes unite to form a *Y* with a short length of pipe leading to the fan which in this instance is mounted in the reverse position to that usually assumed, that is with the discharge nozzle above instead of below. A blast gate in the pipe near the nozzle of the blower, regulates the volume of air. The pressure is indicated by a mercury gage connected to one wind box as shown in the illustration. In the present instance the turbo blower is far larger than necessary and was pressed into service because it happened to be on hand and standing idle. A blower capable of delivering 250 cubic feet of air per minute at a pressure of 5 ounces would serve admirably. Greater pressure and volume blows an excess of sparks through the open top. Lower pressure results in a low melting zone and cold iron.

The bottom plate and legs of the small cupola follow the design of the large regular cupola, scaled down to (*Please turn to page* 48)



The shell of the baby cupola is made of two ordinary steel drums, one on top the other

N. K. B. PATCH
President

ALLEN B. NORTON
Vice President

SAM TOUR
Secretary-Treasurer

Set Up Nonferrous Association

Elected directors organize national body to which nonferrous foundries assign interests

FORMAL organization of the Nonferrous Foundry association for industrial recovery was effected in Chicago, July 20, at a meeting of representatives from the ten districts covering the entire United States.

In addition to the regularly elected delegates and alternates, the sessions were attended by a number of brass and aluminum foundrymen from Ohio, Indiana, Michigan, Wisconsin and Illinois.

The by-laws, proposed by a committee appointed at a meeting of the industry held in Chicago during the American Foundrymen's association convention, were revised and approved. Under these, the representatives elected by the ten districts with representatives chosen by the different branches or groups of the industry, will compose the board of directors. Provision is made to permit membership by any individual, firm or corporation engaged in the manufacture of nonferrous castings. A group of permanent mold castings makers indicated its desire to become affiliated at once with the new association.

A nominal scale of entrance fees is provided, ranging from $10 for foundries producing 10,000 pounds or less of castings per month to $100 for those making in excess of 250,000 pounds a month. The schedule of dues will be assessed following the establishment of a budget and will be prorated upon the basis of man hours of labor employed for the quarter previous to the date upon which the dues are payable.

Elect District Representatives

The ten geographic districts and the representatives elected who will serve as directors of the association are as follows:

District No. 1—New England States, Justin A. Duncan, William Duncan & Co., East Boston, Mass.

District No. 2—Metropolitan New York, New Jersey, that part of Pennsylvania east of a line running north and south through Harrisburg, but including Harrisburg, Delaware and Maryland. W. E. Paulson, Thomas Paulson & Son, Brooklyn, N. Y.

District No. 3—New York State, other than Metropolitan New (*Please turn to page* 40)

Questions and Answers

Covering important problems found in all phases of modern foundry practice

This department includes problems relating to metallurgical, melting and molding practice encountered in making castings. Questions addressed to the Editor of The Foundry will be answered by members of the editorial staff, supplemented where occasion requires by the following advisory staff: Steel, John Howe Hall; Malleable, H. A. Schwartz; Gray Iron, John W. Bolton; Nonferrous, N. K. B. Patch

Limestone Not Essential For Small Heats in Large Cupolas

In running small heats of six to eight tons, is the use of limestone beneficial or detrimental to the iron? Our cupola is 50 inches inside diameter; the bed is 40 inches above the tuyeres; blast 5000 cubic feet per minute; 1600 pounds of coke in the bed; 225 pounds of coke between charges with 2000 pounds of iron to the charge, and 60 pounds of limestone per charge.

With such small heats in your large cupola, we do not believe that the addition of limestone or lack of it will make any noticeable difference. The heat you mention will be melted in about half an hour, and you will find that no trouble will be encountered if no limestone is added. With a smaller cupola that would require several hours to melt the six or eight tons, use of limestone would be advantageous.

Malleable Iron Castings Peel on Surface When Annealed

We are experiencing difficulty with a certain peeling on the surface of extremely light malleable iron castings after they come through the anneal. They are annealed in mill scale. Analysis of the hard iron is as follows: Silicon 0.96 per cent, carbon 2.72 per cent, manganese 0.30 per cent, sulphur 0.09 per cent. We would appreciate any information you can give us on the cause of said peeling.

Peeling will not occur unless there have been conditions in the early stages of anneal to oxidizing that the surface of the iron casting has been oxidized and not merely lowered in carbon content. A brittle scale then forms which may or may not be converted into iron later in the cycle, depending upon the composition and temperature of the pot gasses. The most probable explanation in the present case is that an attempt is being made to keep the packing decarburizing by the use of too active an oxidizing agent in relatively small amounts. The chemical composition of the iron has nothing to do with the result directly. The annealing condition should be looked into.

It is suggested that the article "Oxidation Phenomena during the Annealing of Malleable Cast Iron" by H. A. Schwartz, Cleveland, in the 1928 "Transactions of the American Foundrymen's Association," page 385 to 396, probably contains information of interest in this particular case.

Casting Pure Copper In Sand Molds Is Troublesome

We have tried to cast a copper bushing for making copper gaskets and have been having trouble. The metal inset bushing is spongy. We melted the copper in a crucible in the same manner as ordinary brass and bronze, a temperature of 2100 degrees Fahr. and cast it into a green sand mold of ordinary Albany brass sand. We used a mixture of flour sand core and have also used an oil sand core. On either cores the appearance of the bushing was the same. We used a brass flux in the crucible. Can you give any advice on how to overcome the trouble?

Casting of pure copper in sand molds is a troublesome problem at best. Most producers of commercial copper castings in reality are casting an alloy of copper rather than pure copper. They add a small amount of zinc or silicon or magnesium to the copper. In some instances, the copper plus phosphorus is used. Each of these different compounds have their own peculiarities and consequently demand a certain skill or experience.

Pure copper, unless it is properly deoxidized by the addition of some deoxidizing agent, such as phosphor copper, zinc, silicon, magnesium or tin, will give a spongy casting in sand molds and frequently will be so full of gas as to boil

out of the mold through the risers or the pouring sprue and make a most unsatisfactory product. Unless it is absolutely necessary that the copper should be pure on account of some peculiar condition, an alloy is much to be preferred.

We believe your problem is best answered by making your castings of some alloy of copper in which the minimum amount of alloying metal is used so that you can approach pure copper as closely as possible. We believe that you will find the addition of say, 1 per cent of zinc to your copper to be the simplest answer, or if the casting is to be used where zinc cannot be present, some other metal can be added, such as magnesium. A small amount of magnesium, say ½ of 1 per cent should give you sound castings if properly melted, and poured at a low temperature.

We believe your molding practice is good as you describe it, and that your troubles are not traceable to that phase of manufacture.

Casts Aluminum Alloy Pistons in Permanent Molds

We have occasion to cast a few aluminum pistons. Can you give us any information on the best aluminum alloy to use for a satisfactory casting in a metal mold?

Pistons made in metal or permanent molds usually are of an aluminum alloy containing 87 per cent aluminum, 9.25 to 10.75 per cent copper, 0.90 to 1.50 per cent iron, and 0.15 to 0.35 per cent magnesium. That alloy may be purchased in ingot form from the manufacturers. The best properties may be developed by heat treatment.

Steel Bars Suitable For Use in Machine Castings

We have a considerable accumulation of shorts of intermediate grade billet steel concrete reinforcing bars rolled to A. S. T. M. specification A-15-30. This grade constitutes the bulk of this scrap although we have from time to time an injection of rail steel bar shorts and perhaps some foreign shorts. We want to use this as a feeder for our gray iron foundry, and want to know if it is usable in machine castings, and if so how the characteristics of those castings would be affected by its introduction in say from 15 to 30 per cent of the charge.

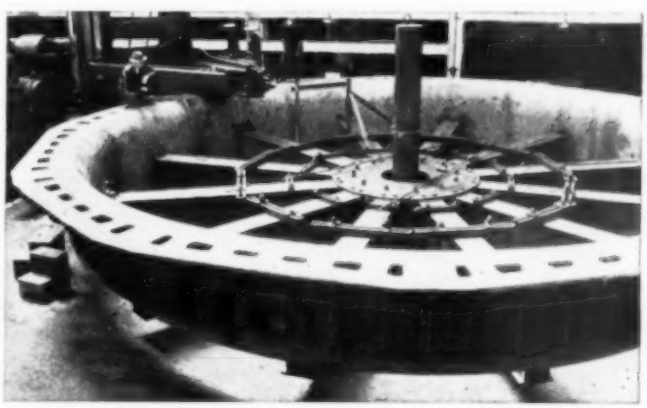
This material is suitable for use in mixtures for machine castings. Two major factors must be taken into consideration. First the lengths must be short enough and carefully placed in the cupola to avoid possibility of hanging up the charge. Unless the material is less than half the cupola diameter in lengths it may prove difficult to charge as much as 30 per cent without danger of hanging up. It should preferably be placed in the center of the charge, away from the edges, the heavier pig and scrap being charged around the edges. A reasonable amount of limestone and proper amount of air will minimize iron loss. Second it will be necessary to compensate for the low silicon content of the reinforcing bars, the same problem one has when charging any sort of steel.

We realize that merely shoveling this stuff into the cupola, and letting it take its place naturally the smaller sections would perhaps melt too quickly or partially be burnt out. Perhaps fagotting the smaller sections would get away from even that difficulty.

Obtain Harder Iron By Reducing Silicon Content

We operate a small iron foundry and at the end of each heat we pour white iron liners and wearing plates for crushing gold ore. Our present mixture consists of 50 per cent scrap brake shoes and the rest white iron sash weights, white iron runners and scrap. To that mixture we make a ladle addition of 2 per cent ferrochromium containing 70 per cent chromium and 5 per cent carbon. Can that mixture be improved upon? We have heard that a small amount of copper would increase the wearing qualities of the iron, but no one could say why. Would a ladle addition of ferromanganese have any beneficial effect?

While we do not know the exact analyses of the various materials entering into your white iron charges, rough approximation indicates that the iron contains about 1 per cent silicon, 0.25 per cent manganese and 1.25 per cent chromium. Presumably you could obtain a harder iron by reducing the silicon content to some degree dependent upon the thickness of the sections of the castings. Increasing the chromium content to 3 per cent or as high as 6 per cent will give an extremely hard iron which is said to have good wear resisting qualities. The manganese content is too low and it is suggested that you add ferromanganese to bring it up to between 0.50 and 0.60 per cent. With 1000-pound charges about 4½ pounds of 80 per cent ferromanganese should be added to the mix.



Throat liner for one of the penstocks at the Boulder dam. The liner was cast in 12 sections with each section machined, drilled and bolted together to form a unit 36 feet in outside diameter and weighing 40 tons. Illustration courtsey Westinghouse Electric & Mfg. Co.

You do not state how much iron is in your ladles when you add the ferrochromium, but to obtain the best results, it is not recommended that you add more than 1 per cent by that method. Ferroalloys may be purchased in briquet form covered with refractory material which are added with the iron charge. Addition of the alloys in that form is claimed to increase the recovery, and insure uniform mixing. While copper is employed in some instances to increase the corrosion resistance of steel and iron, we do not believe that it will increase the wearing quality

Changing Gate Will Eliminate Dirt

We are sending a gate of manganese spoons. The two spoons are gated at one point approximately in the center of the handles with shrinkers at the ends of the handles and a riser at the end of the bowls. We have gated up to four places at one time without being able to eliminate the dirt. We have made them with and without cores, and at present the cores are sprayed with plumbago. We have coped each side of the spoons, and the present way shows up best. I am using 30 per ingot and 70 per cent return scrap with about 2 ounces of manganese copper added.

The reason you have been unable to eliminate dirt from your castings is due to the method of gating. Your attention is called to the handle portion of the castings where you will note that it is clean and perfect. Also the little shrinkers and risers are nice and clean, but the spoon shows dirt because the gate is in the wrong position. You will have better results if the gate is located on what now is the riser end with a thin gate cut into the bottom of the riser. That will fill the spoon gradually, and flow into the little riser and the end of the spoon. Make the metal flow uphill, and eliminate all agitation of the metal while the mold is being filled. Spraying the cores with plumbago is good practice.

Coat the Chills In Malleable Foundry

We shall appreciate your recommendations for a chill coating to be used on malleable castings which are poured reasonably hot and where the molten metal passes over the chill face. We have been using shellac and sand, but as shellac has advanced materially in price recently, we are looking for a suitable substitute. We have experimented with sodium silicate and a few other coating materials but without satisfaction.

We are not quite clear whether you are referring to outside chills, or, to inserts. Mention of sand coating would seem to infer an insert which must move freely—for example a swivel hook—after the casting has cooled. For this purpose any of the liquid core binders will serve, with the proviso of course that the coated chills are dried thoroughly in the oven before they are placed in the molds.

Linseed oil is used extensively for the same purpose in many malleable foundries. On many outside chills no coating is required, provided the chill is perfectly clean and dry. Where the service is unusually severe—running stream or thick section—the chill may be coated with blackwash and dried, or, coated with a light oil and dusted with blacking or silica flour.

Take Chill Test Before Pouring Castings

Kindly prescribe an iron mixture that will chill to a depth of ¼-inch on a plate casting 4 x 4 feet, and 3 inches thick. What thickness of chiller is required. We have a quantity of car wheel scrap available.

Imparting a chill exactly ¼-inch deep to a plate 4 feet square and 3 inches thick is a rather unusual problem and probably will involve some little experimenting. Solution of the problem depends on two main factors. The depth of chill increases with the decrease in the silicon content of the iron, and also increases with the increase in thickness of the chiller. The amount of phosphorus, sulphur and manganese in the iron also affect the final result to a certain extent. For the foregoing reasons, the makers of chilled castings always take chill tests during the progress of the heat as a check against the chemical analysis. Corrective measures are applied where variation from the standard is observed.

Iron of the following analysis will meet your requirements approximately: Silicon 1.50 per cent, sulphur 0.10 per cent, phosphorus 0.40 per cent, manganese 0.70 per cent. Charges made up half and half car wheel scrap and No. 2 foundry pig, will yield an iron of approximately that analysis. Certainly many other combinations may be assembled to give the same result. Before pouring the metal in the mold a small amount from the ladle should be poured into an open sand mold 3 x 3 x 8 inches in which the bottom face of the mold is formed by an iron slab at least 3 inches thick. This test piece is cooled and broken and the depth of the chill will indicate whether the iron is in condition to pour into the casting or not.

If the chill is too deep a little ferrosilicon may be added to the iron in the ladle, or iron from a succeeding tap—assuming that it is softer—may be added to the iron in the ladle. The casting will weigh 1800 pounds and probably will be poured from a 2 or 3-ton ladle. No really satisfactory method is available for increasing the chilling property of the iron once it is in the ladle. Where a large number of castings are required, a single large chiller is preferable, but where only one or two castings are ordered, a chiller in four sections each one foot square and 3 inches thick will be found more convenient to make and use. They should be spaced about ½-inch apart and the joints filled with dry parting sand to prevent the iron from flowing down between them and probably causing an explosion.

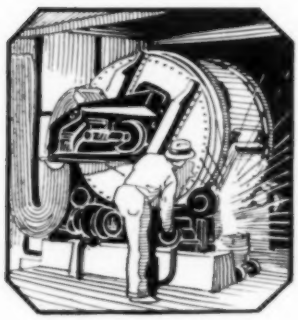
Lower Silicon and Add Alloys to the Metal

We are manufacturing a device that is attached to the inside of a furnace door for supplying additional preheated air above the coal fire. These are made of stoveplate iron, but we would like to get some information on iron that is more resistant to heat. Will the addition of nickel, chromium or steel to our regular stoveplate mixture produce a casting that will stand up better?

You do not state whether you are just making a few of these castings in with your others, or a considerable number. If the latter is the case, you can pour them with a special charge or two placed at the beginning or end of your regular stoveplate heat. The end may be preferable as the cupola may be a little hotter. Reduce the silicon content of your regular charges by replacing some of the raw material with steel scrap. While we do not know the thickness of the castings, we believe that a silicon content of 2 per cent will be satisfactory. In addition to lowering the silicon content, it is suggested that you add about 1.50 per cent nickel and 0.60 per cent chromium to the mixture.

An alloy iron that is claimed to be resistant to temperatures up to 1500 degrees Fahr. contains 14 per cent nickel, 6 per cent copper and 2 per cent chromium. The nickel and copper contents may be obtained by incorporating about 20 per cent monel metal in the regular iron charge, and making a ladle addition of ferrochromium. The latter also may be added in briquet form in the cupola. Heat resistant castings also may be made by including about 20 per cent of a special pig iron containing nickel and chromium in the mixture. For light castings such as those you mention the silicon should run about 2 per cent.

Viewing Foundry Developments



At Short Range

TO PREVENT aluminum alloy castings from sticking to metal molds, the latter are painted with a solution containing graphite and silicate of soda. The graphite is that type known as colloidal, and suspended in water. The recommended composition is one part of colloidal graphite suspended in water, 10 parts of water and 6 per cent of silicate of soda.

♦ ♦ ♦

Monel metal scrap is being used extensively as a substitute for nickel in other forms as an alloying element in producing gray iron castings.

♦ ♦ ♦

What appears to be reversion to ancient Chinese molding practice is indicated in a patent granted for brake shoe molds. The portion of the mold forming the back or gray portion is made of ground, fused silica bonded with fireclay while the chilled face of the mold is formed either of metal or silicon carbide. The mold before use is baked and burned to make it withstand repeated use.

♦ ♦ ♦

ALUMINUM and silicon adversely affect the appearance and physical properties of journal bearings and locomotive driving brasses according to a series of experiments conducted recently at a prominent Canadian foundry.

♦ ♦ ♦

A new development consists of a special pig iron, a synthetic product of the open-hearth furnace, for the benefit of foundrymen who have been troubled with broken castings in the cleaning room. The metal contains a little copper, 0.10 per cent phosphorus, 2.40 per cent silicon, 0.70 per cent manganese, and total carbon 3.40 per cent. The tensile strength is 37,000 pounds per square inch and the metal runs freely in the ordinary 1/10-inch section found in stove foundries and shops devoted to the production of light, thin castings. Fracture of the metal shows a dark uniform grain particularly adapted to polishing or enameling.

♦ ♦ ♦

An English foundry has built a pig mold conveyor extending from the foundry floor to the cupola charging platform. Over iron poured into pigs is carried directly to the charging floor.

♦ ♦ ♦

VALVES and other equipment for high pressure or temperature steam and oil lines now are being made of steel containing from a trace up to 0.50 per cent carbon; 4 to 8 per cent chromium and; 0.75 to 2.0 per cent tungsten. It is claimed that the steel has an absence of the brittle range from 900 to 1500 degrees Fahr., and unlike some other alloy steels employed for the purpose, gives an indication of impending failure. The steel possesses a low creep value and is resistant to hydrogen sulphide corrosion.

♦ ♦ ♦

Investigators at a prominent Mid-Western malleable foundry discovered that by super-heating standard commercial mixtures up to 2970 degrees Fahr., and electric furnace iron of low carbon and low silicon content up to 3180 degrees Fahr., the normal malleabilizing cycles may be reduced by 50 per cent.

♦ ♦ ♦

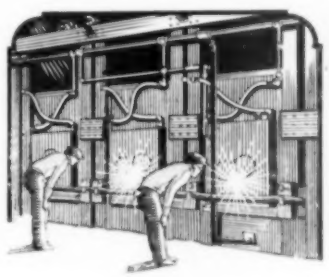
Additions of silicon, nickel and chromium are claimed to confer high heat resistant properties to two cast irons developed in Great Britain. One known as *Silal* contains about 5 per cent silicon and 2.5 per cent total carbon. This iron is not suitable for castings subjected to rapid heating or cooling since it cracks easily. The second iron known as *Nicrosilal* is an austentic gray iron containing for most purposes about 2 per cent total carbon, 5 per cent silicon, 1 per cent manganese, 18 per cent nickel and 2 to 5 per cent chromium. This iron is extremely tough and ductile.

♦ ♦ ♦

BY SUPERHEATING to between 2550 and 3000 degrees Fahr., an alloy iron containing from 0.10 to 2.0 per cent chromium; 0.10 to 2.0 per cent molybdenum; 1.75 to 3.75 per cent carbon; 0.50 to 3.0 per cent silicon, and 0.25 to 2.0 per cent manganese, it is claimed in a recent patent that a matrix of essentially all pearlite interspersed with finely divided particles of graphite is obtained. It also is said that the chromium and molybdenum contents are sufficient in amount to increase the stability of the carbide present at elevated temperatures.

♦ ♦ ♦

A cast iron with a martensitic structure in the cast or heat treated state is said to be well suited for crankshaft production. Such an iron requires a low total carbon (2.25 to 2.50 per cent), low silicon (1.00 to 1.50 per cent) 3 to 4 per cent nickel



and probably molybdenum or chromium These crankshafts have a high hardness and are unmachinable as cast. They are annealed to produce a brinell hardness number of 300 to 320 where they are machinable and possess good strength and toughness. The high hardness of the bearings insures excellent wearing properties.

The FOUNDRY Family Photograph Album

Photo Bachrach

Upper Left
C. W. MILLER
Bartlett-Hayward Co.
Baltimore

Upper Right
D. D. FRANCIS
National Bronze & Aluminum Co.
Cleveland

Lower Left
J. E. HURST
Sheepbridge Stokes Centrifugal Castings Co.
Chesterfield, Eng.

Lower Right
A. J. JOHNSTON
Hickman-Williams & Co.
Chicago

Men of Industry

Whose Activities Are Making Foundry History

C. W. MILLER (See Family Album, opposite page), recently appointed foundry superintendent Bartlett-Hayward Co., Baltimore, began his foundry career with the Coshocton Iron Co., Coshocton, O. Later he moved to Monongahela City, Pa., when the company established a plant there. After a return period of service in charge of the Coshocton foundry he joined the Black Diamond Engineering Co., Black Diamond ,Pa. He again returned to the Coshocton Iron Co., as superintendent and remained until 1913 when he was appointed an assistant superintendent of the General Electric Co. plant at Erie, Pa. After the close of the war he became associated as foundry service engineer with the Herman Pneumatic Machine Co., Pittsburgh. After a period engaged in independent foundry engineer consulting practice he became engineer for the Fort Pitt Flask Equipment Co., Pittsburgh, in 1931.

J. G. GARRARD, has resigned as general manager, Grand Rapids Malleable Iron Co., Grand Rapids, Mich.

OTTO AGRICOLA, president, Agricola Stove & Foundry Co., Gadsden, Ala., was honored recently at a testimonial dinner by citizens of Gadsden, who presented a gold watch to him.

C. F. SMITH has been appointed factory manager of the American-La France & Foamite Corp., Elmira, N. Y., succeeding H. S. SNODGRASS, who has resigned because of ill health.

ALBERT J. SAUTE, for the past 7 years associated with the General Electric Co., as time study engineer, has been made foundry superintendent for L. F. Fales Machinery Co., Walpole, Mass.

HARRY SCULLIN, president of the Scullin Steel Co., St. Louis, has been appointed a member of the board of three for Missouri which will submit to the public works administration projects for giving employment. Although placed on the inactive list after having reached the army retirement age, Mr. Scullin continued to serve as assistant chief of the St. Louis district of the ordinance office and president of the Army Ordnance association.

LLOYD D. BRADY has completed his work for F-I-A-T in Italy and has gone to Paris where he will be connected with the Citroen company for the next six months as a consultant on foundry practice. Mr. Brady's address is Hotel Belfast, 10, Avenue Carnot, Paris.

CLIFFORD F. MESSINGER, president, Chain Belt Co., and affiliated industries, Milwaukee, has been elected a trustee of the Northwest Mutual Life Insurance Co., with home offices at Milwaukee.

EDWARD P. TROUT, formerly sales manager in California for Lufkin Foundry & Machine Co., Lufkin, Tex., has been placed in charge of the company's office recently opened in the Magnolia building, Dallas, Tex.

GUIDO VANZETTI, son of the late president of the Italian foundrymen, has been elected president of the group of steel foundries of the national association of metallurgical industries of Italy. Mr. Vanzetti is thus following in the footsteps of his father.

WILLIAM W. COLEMAN, president of the Bucyrus-Erie Co., South Milwaukee, Wis., has returned after an absence of 3 months in Europe. After visiting the company's British affiliate, Ruston-Bucyrus Ltd., he spent some time on the Continent.

GEN. THOMAS S. HAMMOND, president, Whiting Corp., Harvey, Ill., president Illinois Manufacturers' association and the retiring president of the American Foundrymen's association, has been appointed executive director of the emergency re-employment campaign by President Roosevelt.

D. D. FRANCIS (see Family Album, opposite page), recently elected a director of the Nonferrous Foundry Association for Industrial Recovery, is vice president and treasurer, National Bronze & Aluminum Foundry Co., Cleveland. Mr. Francis was graduated from the U. S. Naval academy with the class of 1919 and resigned from the Navy in June, 1921, to enter the employ of the Marvel Carburetor Co., Flint, Mich., in the engineering department. In October, 1921, he became assistant superintendent and in March, 1925, was made production manager of that company. In 1927 he was elected secretary and treasurer of that organization.

From April, 1928, to February, 1932, he was president, Wheeler-Schebler Carburetor Co., and secretary and treasurer, Marvel Carburetor Co. He became a director of the Borg-Warner Corp. in 1929 and still serves in that capacity. In 1932 he resigned from the carburetor companies to become vice president and treasurer of the National Bronze & Aluminum Foundry Co.

J. H. COLLIER has been elected vice president of Crane Co., Chicago, succeeding CHARLES A. WAYMAN, who remains with the company in an advisory capacity. Mr. Collier formerly was general manager of European subsidiaries and his election as a vice president follows the abolition of the former office.

V. S. VEENMAN, formerly foundry foreman for the Superior Bronze & Aluminum Co., Warren, O., and later foundry superintendent for the France Foundry & Machine Co., Toledo, O., recently has accepted a similar position with the Nolte Brass Foundry Co., Springfield, O. Mr. Veenman is in charge of bronze bushings and general jobbing castings.

J. E. HURST (see Family Album, opposite page), recently elected junior vice president of the Institute of British Foundrymen, is technical director, Sheepbridge Stokes Centrifugal Castings Co., Ltd., and also technical director, Bradley & Foster Ltd., Darlaston. He has been associated intimately in the development of the centrifugal casting process in

Great Britain, particularly in its application to special cast irons for high-duty purposes, and was manager of the centrifugal casting department of Newton Chambers & Co., Ltd., which now has been merged into the organization with which he is connected.

Mr. Hurst formerly was assistant chemist to Beyer, Peacock & Co., Ltd., Gorton, Manchester. He became successively chief chemist and metallurgist to Richard Hornsby & Sons, Ltd., Grantham and Stockport, and chief chemist and metallurgist to D. Napier & Sons Ltd., Acton, London. Later he was connected with the centrifugal casting process with Stokes Castings, Ltd., Mansfield, and Centrifugal Castings, Ltd., Kilmarnock.

He is the author of several well known text books, including *Melting Iron in the Cupola* and *Metallurgy of Cast Iron*. He has made numerous contributions to technical societies, is an active member of the Institute of British Foundrymen and senior vice president of the Sheffield branch. A year ago he was awarded the Oliver Stubbs gold medal in recognition of his important contributions to the metallurgy of cast iron. In 1924 he presented the annual exchange paper to the Belgian Foundrymen's association, and in 1926 prepared the annual exchange paper to the A. F. A. He also is a member of the Council of the British Cast Iron Research association and a member of the Staffordshire Iron and Steel institute.

Reader's Comment

EDITOR'S NOTE — *Material Appearing Under this Head Does Not Necessarily Reflect the Opinion of* THE FOUNDRY *or of Its Editors.*

Hardships

There are a number of articles appearing in the different periodicals discussing the attitude of industry in regard to the National Industrial Recovery act. Almost universally the opinion is expressed that a large amount of blame attached to industry has brought about this act. As one who is interested in industry, I suppose it is not ethical that I should point out that some of the blame for the conditions which prompted the new action by the government are traceable to others than industry.

I refer to the fact that prosperity is generally defined as the combination of favorable circumstances and the number of factors governing the relative amount of prosperity experienced at a given time. Industry alone cannot produce a prosperous condition in the United States; industry and labor combined, even if they were to be in perfect accord, could not produce prosperous conditions, even if they were to have, as they are supposed to have, under the industrial act, the perfect support of the government regarding their own activities. It seems to me that it is only fair to industry that the need of co-operation between industry and finance be emphasized and that the shrinking up of credit within the last several years, quite logically bears its share of responsibility for the need of this recovery act.

If this is true, then we must not expect too much for the effectiveness of this experiment, unless we have parallel with it, the proper support of industry by finance through necessary decrease in credit stringency. We are instructed by the government to raise wages and shorten hours. In some industries this becomes a hardship without relief from the present credit stringency. I realize the government has this in mind; but it does seem to me that the editorials that appear from time to time are not stressing this point in proportion to its influence on the hoped for improvement from present new governmental control of industry.

The ufortunate condition brought about through illegal, unethical practices by bankers and financiers has quite as much to do with the present need for a "new deal" as has any illegal or unethical practice in industry. Many industrial organizations find their available funds reduced as a result of the banking situation of today and when this is coupled with the stringent conditions of credit, it is apparent that to raise wages, shorten hours, and otherwise conform to the requirements of the National Industrial Recovery act, becomes a hardship for such industrial concerns.

To relieve this condition a "new deal" in credit is absolutely essential and the small manufacturing institution is frequently the one which needs it most, but whose problems are least considered because such organizations as the Reconstruction Finance Corp., are not organized to even consider the problems of the small manufacturer.

It would seem to me, therefore, that a great deal of help could be secured if this point were emphasized editorially and otherwise by the press, so that the proper action could be insured on the part of the government.

I am outlining these views to you since it is a point that is not much discussed today and it is entirely overlooked in the editorials that appear from time to time relative to the prospects ahead under this new N. I. R. A. I shall be much interested in any comments you have. Of course, I am not as well informed on what the government has been doing in regard to our banking and financial structure as I am with its attitude to idustry and, therefore, I may be pardoned if I have been somewhat unethical.

A FOUNDRYMAN

Gives 4-H Boys Foundry Instructions

The way in which 4-H club boys, attending a two-weeks' summer school session at Oregon college, Corvallis, Ore., are permitted briefly to picture the romance in casting production, recently has been pointed out by Prof. A. E. Ridenour, of that institution. Five years ago as an experiment, a group of boys was assigned to the foundry as part of their activity on the campus. It was necessary, in the four hours allotted to the foundry, to provide a stunt that would excite a live interest. One of the projects used in the brass foundry was the casting of a watch fob which the boys were allowed to keep. The results were so gratifying that the work was repeated for the following three years, but last year it was necessary that the work be omitted.

This year the schedule provided for 4 hour work in the foundry, the first period being devoted to demonstration practice and the second to molding, pouring and finishing. Three college students, working in the foundry on production work, assisted in taking care of the group. During the week 96 boys were given a brief experience in the foundry.

Organize Makers Of Air Filter Equipment

National Association of Air Filter Manufacturers was organized by leading manufacturers of air filters during the June sessions of the National Association of Heating and Ventilating Engineers in Detroit. One objective was the adoption of a code under the industrial recovery act. J. L. Harpham, Independent Air Filter Co., was elected president; J. S. Irvine, Owens-Illinois Glass Co., vice president; and J. R. McConnel, American Air Filter Co., secretary.

Holds Summer School

A summer school for engineering teachers of mining and metallurgical engineering was held at Madison, Wis., July 5-July 25 under the auspices of the Society for the Promotion of Engineering Education and with the co-operation of the University of Wisconsin, Engineering Foundation and the Carnegie Corp. of New York.

Prevent Losses with

Proper Gates and Risers

By PAT DWYER

ALTHOUGH appearing to contradict some previous statements on bottom pouring, the method is recommended for bulky castings of uniform, or approximately uniform cross section, as for example long plugs or sticks. Theoretically in a casting poured in this manner the hottest metal will appear at the bottom, while the coldest metal will appear at the top, thus interfering with the natural process of liquid shrinkage which works downward from the top.

The foregoing disadvantage is more apparent than real. The metal may be poured so rapidly through a large sprue and gate that the temperature of the metal at the top will differ but little from the temperature of the metal in the bottom of the mold. In many castings of this general character the feeding riser merely is a continuation of the mold cavity. Therefore any dross or other foreign floating material will be carried up into this part of the casting which eventually is cut off.

Metals Shrink Differently

A certain hazard attaches to this method of introducing the metal to the mold. Unless the metal is hot and rises rapidly in the mold some drossy material may become attached to the wall of the mold. The method usually is reserved for castings in which the height renders it inadvisable to drop the metal from the top, or, for castings in which the metal can be driven rapidly straight up into a large riser.

The primary purpose of a gate is to admit metal to the mold. A secondary purpose, one sometimes ignored by the maker of the gate pattern, or by the molder who cuts the gate, is that the metal in the gate is required to feed the casting. All metals do not shrink to an equal extent. Furthermore shrinkage is not uniform in all castings made of the same metal. A gate that serves satisfactorily for one metal may prove a failure in another.

For example, many castings in phosphor bronze gated with no particular precaution for feeding, would show decided shrinkage cavities if poured in copper, yellow brass, aluminum bronze, manganese bronze, gun metal, or other alloys, if gated in the same manner. Aluminum also is in this class and usually has to be fed.

Exceptions arise occasionally, but as a general rule the proper time and place to feed a casting may be determined by common sense backed by experience. Castings must be fed where the bulk is high, heavy or variable, features always present where the bulk is high in the mold or where lower sections of the casting will draw metal during the shrinkage period. Even with bulky castings of uniform section provision should be made in the gate for supplying feeding metal.

Consider the following illustration. A 6-inch cube contains 216 cubic inches of metal in compact form. Molded and cast in the usual manner this casting will present an appreciable shrinkage cavity in the center of the top side unless additional metal is supplied through a large feeding riser. Up to the present, no published data is available to show whether this condition could be prevented by pouring the casting through a horn gate at the bottom connected to an exceedingly high head, or, through a small pencil gate at the top. Satisfactory results in this respect have been noted by experimenters with gray iron and bronze castings, but so far as the author is aware neither method has been tried by aluminum foundrymen. Comment on this feature will be appreciated.

Diffuser Over Large Oven

A rectangular aluminum casting 2 x 9 x 12 inches contains the same amount of metal as the 6-inch cube. The metal is not in the same compact form as the cube, therefore the total shrinkage is diffused over a larger area, instead of being concentrated in the center, as with the cube. Even with the 2 x 9 x 12-inch casting the top surface will show perceptible evidence of shrinkage if additional metal is not fed through large gates or through a feeding riser on the top.

The cubical content of a third casting ½ x 18 x 24 inches, is the same as that of the 6-inch cube or the 2 x 9 x 12-inch slab, but poured under normal conditions through practically any form of gate, will show no evidence of shrinkage. The total volume of shrinkage in this casting is the same as that of the others. However, the shrinkage is distributed so uniformly over such a large area, that it is not apparent.

In each of the foregoing instances, the period of time the metal remains in the molten state in the mold, is the controlling factor. Thus in the cube the walls freeze first and draw metal from the still molten center. Where no further metal is available, for example from a feeding riser, to compensate for this loss, the center of the casting will show a cavity. In the slab the metal solidifies almost uniformly, therefore the tendency to develop a cavity is not so pronnounced. The third example selected for illustration, the comparatively thin plate passes from the molten to the solid state almost instantly and no one part draws metal from any adjoining section.

Where a shrinkage cavity shows up close to the gate entrance, it may

Chills Have Place

TOTAL shrinkage in any group of castings of like cubical content is the same. In thin castings of large area the shrinkage is diffused to such an extent that it is not apparent. In thick, heavy castings the total shrinkage is concentrated in a comparatively small area and shows up as a cavity in the casting unless precautionary measures are taken. Shrinkage preventative measures include, gate design, feeding risers and chills, both internal and external. In many instances a combination of remedies must be applied since it is not always possible to apply a chill or a riser to the best advantage. Pouring different parts of the casting with metal of varying temperature, sometimes is adopted to equalize the cooling speed.

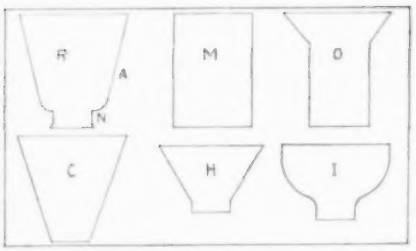


Fig. 210—With the exception of A the various types of feeding risers shown here present certain unsatisfactory features

be traced to a gate faulty in design or shape. Formulas are available for determining the correct area of a gate in relation to the weight of the casting, but in many instances the cross sectional area of the gate is an important factor and this factor is a variable depending on the thickness of the casting at the point where the gate is attached. In thin castings the choice is limited arbitrarily. Manifestly if the gate is thicker than the casting it presents a hazard of breaking a piece out of the casting, or, of setting up a *draw* at the point of contact. On other castings a wider choice is available and the best type of gate under any given condition is governed by expediency and local conditions.

Take Care Of Shrinkage

Thus on a thick or comparatively thick casting, a wide thin gate will set while the metal in the mold still is fluid. Consequently the casting must depend on other factors—if any are available—to take care of the ensuing shrinkage. Metal in a gate a little thicker will remain liquid for a longer period, but where it sets while the shrinking metal in the casting still is feeding from that point a defect known as a *draw* is developed. Expressed in another way, the line of communication is shut off and the metal in the casting at that point is drawn inward. The ideal result is secured from a large gate well backed by a generous sprue in which the metal will remain fluid and feed the casting, either until the entire casting has solidified, or, until the section in immediate contact with the gate has solidified to a point where any danger of a draw is obviated.

This is the basic principle underlying all feeders whether in the form of gates or risers. Metal should remain liquid and in free communication with the casting, until the metal in the casting solidifies. Since gravity is an important factor in the process of shrinkage, the metal in the riser should be carried to a reasonable height. The essential requisites for a proper feeding riser may be set forth briefly as *high, heavy* and *hot*.

Where no impediment is present to prevent contraction, several of the risers shown in Fig. 210 might serve, but the riser *A* is best for nearly all conditions. The neck *N* is of ample size to remain open until the casting sets. The reservoir maintains the temperature and supplies the volume and pressure. This type of riser may be placed on the top or the side of a casting. Riser *M* usually is too small. The neck is too long in *O*. In *C* the neck is too small. Riser *H* is too short, while the basin in *I* is too shallow. For any given volume of metal the riser circular in cross section, is more efficient than any other shape.

Chills are employed extensively in aluminum foundry practice to prevent or reduce shrinkage in heavy sections. Chilling may be effected either internally or externally. Pieces of iron, copper, bronze, carbon, aluminum or other refractory and heat absorbing material conforming to the contour of the casting are rammed in place against the face of the pattern. In some instances the entire face of the pattern is covered in this manner, while in others the chills are placed over the particular sections which require this service. Intricate chills usually are cast from plaster of paris patterns.

External chills do not constitute a perfect remedy in all cases. The effect extends only to a limited distance in the casting. In exceptionally heavy castings, riser feeding is necessary to supplement the action of the chills on the surface.

Internal chilling is effected by placing pieces of wire, nails, or other aluminum parts in these parts of the mold where excessive shrinkage of the casting is anticipated. The function of these chills is to extract the heat rapidly from the metal in the immediate vicinity. If these chills are too large they will not fuse with the surrounding metal and this may constitute a defect in some castings. In others this may be a factor of minor or no importance. However, usually it is necessary to use only a chill which will fuse with the surrounding metal. Metal inserts in aluminum, as in any other metal, must be perfectly clean and dry. Chilling, either internal or external is not a panacea for shrinkage in heavy aluminum castings.

Try Different Methods

This feature was demonstrated in an interesting manner on three 6-inch cubes cast according to three different methods. The first was molded in sand in the usual manner and gated on top. The second was chilled on all six sides and also gated on top. The third was chilled on five sides and fed through a large riser on the top. The three castings were poured from the same ladle.

The all chilled casting showed evidence of shrinkage on the top surface although not to the same extent as on the unchilled specimen. It was not examined for internal

(*Concluded on Page* 34)

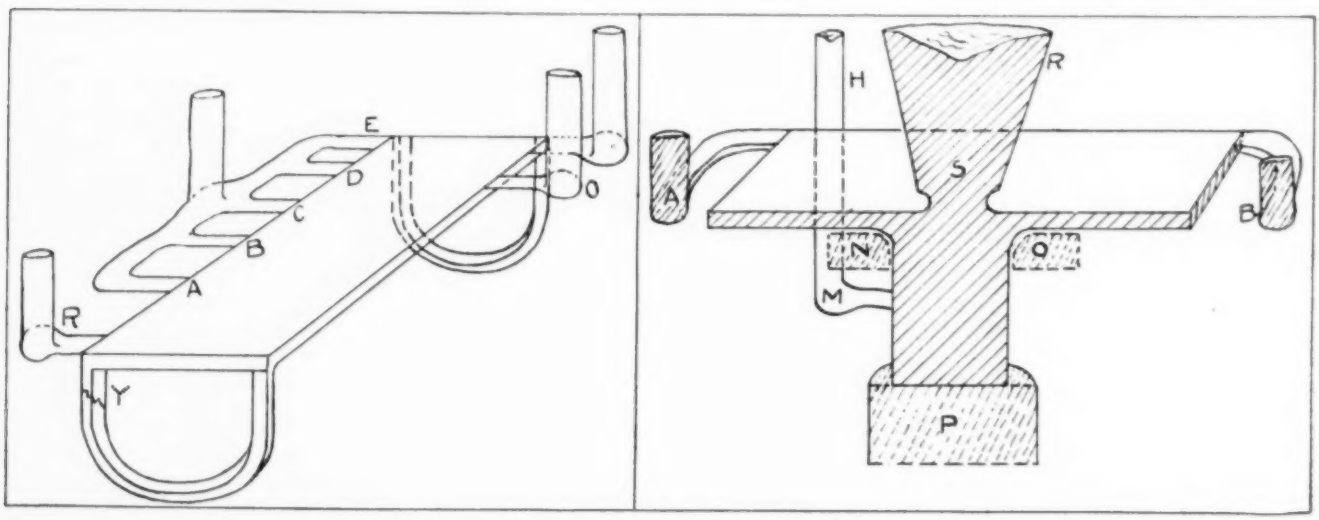


Fig. 211 (Left)—single gates at R and O allow the metal to fill the bands first. Fig. 212 (Right)—Combination method for prevention of shrinkage in hub casting

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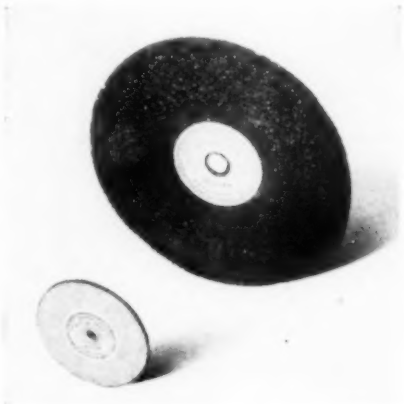

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THE MATERIAL OF A THOUSAND USES

(*Concluded from Page* 32)

shrinkage, a condition undoubtedly present, since the third casting, the cube both fed and chilled, was perfectly solid and weighed 5 ounces more than the second casting.

A method sometimes employed to control the shrinkage problem is to pour metal of different temperatures through two gates, hot metal into the thin section of the casting and cooler metal into the heavy section. An application of this method is shown in Fig. 212.

Cold metal from the sprue *H* enters the mold through the bottom gate *M*. Hotter metal from two other pots enters the thin part of the mold through gates *A* and *B*. Chills to promote rapid freezing of the metal in the heavy hub are indicated by *N*, *O* and *P*. Cold metal from the first pot is poured down the sprue *H* until it rises almost to the top of the hub in the mold. This point readily is determined by looking down the riser. Hot metal from the other two pots then is poured simultaneously through the gates *A* and *B* leading to the thin part of the casting. This metal unites readily with the colder metal in the hub but does not sink. Pouring through the gates ceases when the metal appears in the riser. Metal from one of the hot pots is poured directly down into the riser until it is filled to the top.

Adapted To Meet Conditions

The foregoing illustration shows in a single unit, the usual methods employed for controlling shrinkage and their effect in combination. The chills and the low temperature of the metal reduce the shrinkage propensities of the metal to a considerable extent by the time the hub is filled. The active shrinkage area is moved upward and directly under a supply of hot metal in the riser. The general arrangement may be adapted, amended, curtailed or improved to meet special conditions.

Aluminum castings crack easily during the contraction period. This form of defect may be caused by mold resistance, or, marked difference in the cooling time between adjoining sections. The second feature is influenced by the total contraction and the strength of the metal. In some instances both factors are present and naturally the effect is intensified. Occasionally the position of the gate or riser may be responsible for a cracked casting. Resistance may come from hard sand either dry or green, from gates and fins, from friction of the sand bearing heavily against the metal. Hard dry sand cores are a prolific cause of cracked castings. Where the total contraction is great, as for example a comparatively thin ring 40 inches in diameter, a solid green sand core will cause the casting to crack.

A sprue or riser acting as a retaining post may cause the casting to crack. In some instances the weight of the cope sand over a large flat area will interfere with normal contraction. Hazard incident to the use of a dry sand core may be removed or minimized by reducing the amount of binder in the sand, by forming the core as a shell instead of a solid block. If necessary the shell may be filled with ashes, green sand, damp or dry, or parting sand.

A method frequently employed to prevent castings from cracking is illustrated in Fig. 214, a thin flat casting gated at both ends. This casting cracked at the points marked *R*, *S* and *T* and at the corresponding points on the opposite side. Green sand cores hollowed out in the center were substituted for the dry sand cores formerly employed for forming the hexagonal openings. Metal in the shallow tie bars *A*, *B*, *C*, *D*, *E*, and *F* strengthened the casting. Heavy fins *H*, *I*, *K*, *M*, *N* and *O* acted in a similar capacity on the outside. In addition to these precautions the sand was dug away around the sprues and the cope was lifted off as soon as possible after the casting was poured.

A change in the style of gating solved the problem of the cracked casting shown in Fig. 211. The first castings poured through the branch gate *A*, *B*, *C*, *D*, *E*, at the side, cracked in the band at the point marked *Y*. Two single gates *R* and *O*, one at the opposite corner from the other, were substituted for the long branch gate and the metal was poured two-up. In this manner the bands at the ends received the first metal and had time to solidify before the strain was imposed upon them by the contraction of the upper plate.

This is the forty-third of a series of articles dealing with the various types of gates and risers used in the foundry industry. The forty-fourth will appear in an early issue.—The Editors.

Volume Contains Standards for Metals

Standards and Specifications for Metals and Metal Products, the third volume of the Encyclopedia of *Specifications*, recently has been published by the United States department of commerce, bureau of standards. This large volume, containing 1350 pages, reproduces the substance and form of all available, nationaly recognized specifications for such commodities as are embraced within the numerical classification designations 600 to 699 in the national directory of commodity specifications. This includes iron and steel; iron and steel manufacturers; ferroalloy ores; metals and metal manufactures; aluminum, antimony, bismuth, cadmium and cobalt; copper, brass and bronze; lead, mercury and nickel; precious metals, metal jewelry and plated ware; clocks, watches and dials; tin and zinc; miscellaneous ores, metals, alloys and metal manufactures.

Over 1100 illustrations are included and aproximately 2000 cross-references are provided to demonstrate the close relationship existing among the specifications assigned to metals. The volume may be secured through the superintendent of documents, Government printing office, Washington, for $3.00.

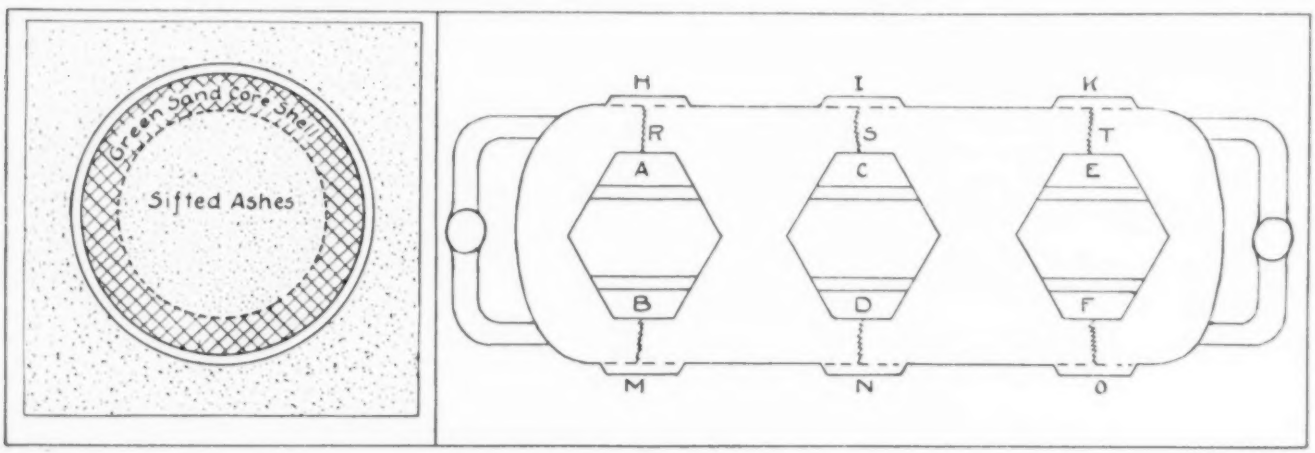
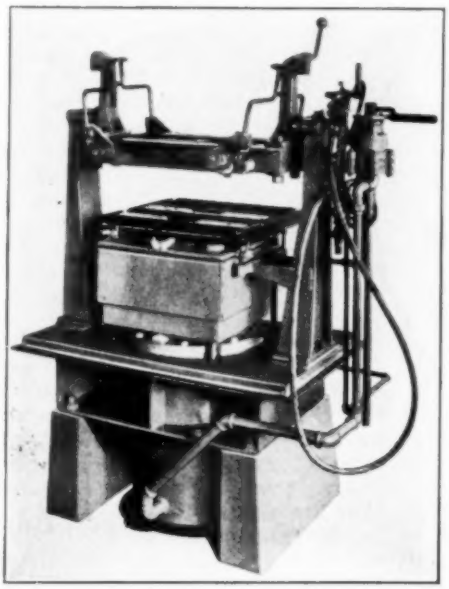


Fig. 213 (Left)—Hollow green sand core filled with ashes allows 40-inch ring to contract. Fig. 214 (Right)—Tie pieces prevent the casting from cracking

TABOR MOLDING MACHINES



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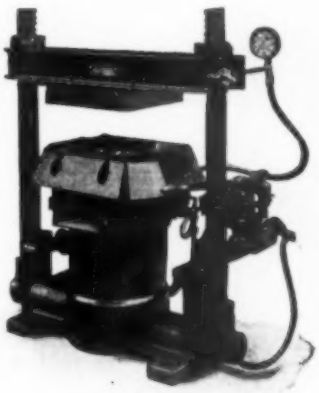

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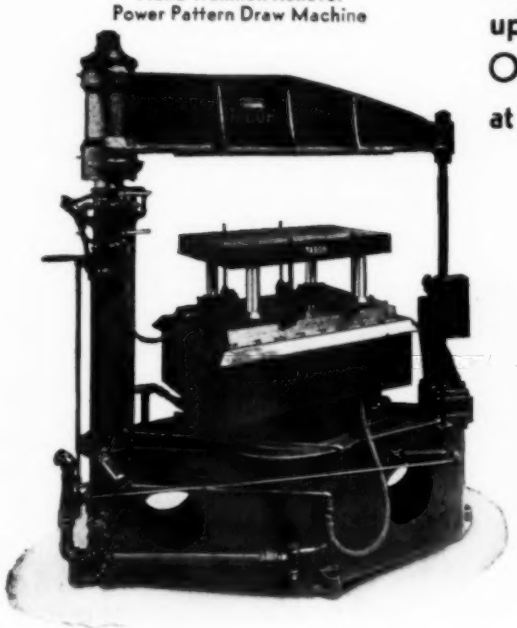

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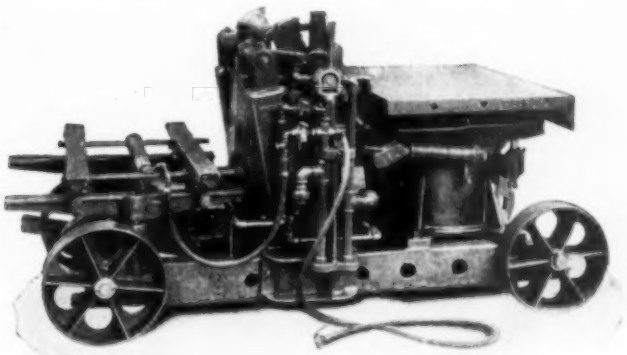

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Convention Leads in Recovery

(Concluded from July Issue)

CONSTRUCTION, operation and application of the small cupola up to and including those 27 inches in diameter inside the lining was described in the opening session of the cast iron shop operation course by D. J. Reese, Whiting Corp., Harvey, Ill. Larger cupolas usually are found in American foundries and as a result practically all published information on the subject has been concerned with larger sizes. Small cupolas have been used extensively for many years in European foundries with satisfactory results for melting comparatively heavy tonnages of iron.

Regulate Size of Coke

The speaker claimed that where conditions warrant the installation of a small cupola, capital charges and operation costs are comparatively much less than for large cupolas. A small cupola requires closer supervision and more attention to detail than one of large diameter. The speaker's views in this and other respects were confirmed by J. T. MacKenzie, American Cast Iron Pipe Co., Birmingham, Ala., who entered into considerable detail in regard to the operation of an 18-inch cupola used for melting alloys and for other experimental purposes. He has found that the size of the coke is an important item toward satisfactory operation, particularly on long runs, sometimes extending to 8 or 9 hours.

Touching on a reference to a 30-ton heat taken from a British 27-inch cupola, Mr. MacKenzie ascribed the success to the use of what is known as a balanced blast and special tuyeres. Answering a member's question on the apparent difficulty of patching an 18-inch cupola, he stated that instead of applying a coating of mud after a short heat, he waits until the lining has burned back about 2 inches and then applies split bricks.

In describing the operation of a 21-inch cupola Gottfried Olson, Chicago, claimed that with proper manipulation, coke no larger than 1½ or 2 inches and with iron broken fairly small he had no difficulty in securing iron with a temperature of 2700-2800 degrees Fahr. Regulation of air volume is important. Too much air exercises an oxidizing effect. With 300-pound charges he has poured castings up to 1500 pounds A half pig of fused soda ash on each charge facilitates the slagging operation which is continuous throughout the heat. This latter observation was in answer to a member who claimed he had no success in attempting to slag a small cupola through the back. C. E. Hellenberg, Foxboro Co., Foxboro, Mass., contributed a written discussion on the advantages of installing a device for regulating and controlling the volume of air.

A. F. A. Convention

THE various activities of the recent A.F.A. convention in Chicago, including committee meetings, conferences, shop courses, technical sessions, general meetings to discuss the place of the industry in the administration of the National Industrial Recovery act, and the exhibition of equipment and supplies, covered such a wide diversity of information that it was found impossible to present all of the many reports in the July issue of THE FOUNDRY. Therefore the reports on the sand and iron shop courses, and sessions on materials handling, sand and refractories, are presented in this issue. The report of the foundry-machine shop session of the American Society of Mechanical Engineers, is on page 40.

Submit Gating Chart

Report of the committee on gating terms including a chart illustrating various types of gates, runners, etc., and their component parts was submitted Wednesday morning at the shop operation course under the chairmanship of John Grennan, University of Michigan, Ann Arbor, Mich., by H. W. Dietert, H. W. Dietert Co., Detroit. This chart is the first step in an effort sponsored by the American Foundrymens association to standardize gating terms in all sections of the country and thus furnish a solid foundation and prevent ambiguity in future discussions touching on any and all phases of the gating subject.

Preliminary work conducted by the committee during the past year indicated the necessity for this movement. Extensive replies to a questionnaire accompanying copies of the chart showed a wide and loose choice in the application of the various terms. The committee accepted the majority opinion on each item and submitted the revised chart to the meeting for comment and ratification. The report was accepted with the proviso that the committee prepare supplementary text of an explanatory character to accompany the chart.

Following a discussion of several debatable points the committee was instructed to take up at its discretion one of the many other phases of the gating subject during the coming year.

The third shop operation course on cast iron was held under the direction of Chairman Garnet Phillips, Frank Foundries Corp., Moline, Ill., on Thursday morning. E. K. Smith, Electro Metallurgical Co., Chicago, one of the leaders of discussion, presented a brief talk on cast iron structures which was illustrated with a series of slides depicting the different constituents. John Grennan, inquired if changes in silicon and carbon content made a difference in the solubility range of phosphide and received an affirmative reply.

Gottfrid Olson, Chicago, gave a brief synopsis of his experience with refractories for small cupolas. He said that refractory costs were somewhat higher for small cupolas as compared to large ones, and that for a 21-inch cupola that the total costs of refractories including relining, patching material, etc. for 100 heats in which 324 tons of metal was melted was $121.18. He recommended that the daubing be composed of ground fireclay brick of 4 mesh, and a good plastic fireclay in the ratio of 2 parts of grog to 1 part of clay with as little moisture as possible.

In answer to an inquiry he stated that castings weighing from a few ounces to 1500 pounds were made during the run, and that the metal temperature varied from 2740 to 2850 degrees Fahr. with an average of 2800 degrees. Mr. Olson said that to obtain that temperature it was necessary to break the iron charges into small pieces and use small coke, otherwise a high spout temperature could not be attained.

Discuss Use of Alloys

The session was concluded with an abstract of the "Recommendations for Cupola Refractories" prepared by the bureau of standards. After a little discussion from the floor a motion was made that the recommendations be referred back to the committee on refractories.

The fourth and concluding shop operation course on cast iron was held Friday morning with H. Bornstein, Deere & Co., Moline, Ill., in the chair. The discussion was devoted to alloy cast iron, and applications, compositions of irons, effect of various alloys were described. E. K. Smith, discussed the use of chromium as an alloying element, and J. S. Vanick, International Nickel Co., New York, spoke on nickel. E. R. Young, Climax Molybdenum Co., Detroit, and H. P. Furlong, Molybdenum Corp., of America, Detroit, dealt with the application of molybdenum to cast iron. Jerome Strauss, Vanadium Corp. of America, Bridgeville, Pa., briefly described

the effect of vanadium additions on cast iron. The use of the various alloys was discussed by Garnet Phillips, John Grennan, Fred J. Walls, Wilson Foundry & Machine Co., Pontiac, Mich. and H. C. Austin, Cannon, Wyant & Campbell Co., Muskegon, Mich.

Show Grain Shape Important

SHAPE of the sand grains of a molding sand has a decided influence on strength and permeability according to a paper presented by H. W. Dietert co-author with Frank Valtier, H. W. Dietert Co., Detroit, at the session on sand on Tuesday morning. Permeability of a rounded grain sand is greater than that of sand with an angular grain, while the strength is less influenced except in case of core sands where oil is used as a binder. The rounded grain sands produce a stronger core than angular grain sands where the same amount of oil is used.

Size of the sand grains is extremely important and the author went into detail as to effects produced by various combinations of base materials. Fine materials below 100 mesh have a great influence in lowering permeability. The green and dry strength of molding sand is not affected within practical limits by the shape of the sand grains. The base permeability of various grain sizes does not change rapidly until grain size increases to above 140 mesh. Above this size each increase of sieve size will give an increasingly greater base permeability. A 10 per cent addition of a much finer size sand grain than the base material may cause permeability of production sand to drop 50 per cent. This explains why green or mold permeability drops or *closes up* in practice.

Many of the points raised by Mr. Dietert were elaborated by Dr. H. Ries Cornell university, Ithaca, N. Y. in a paper "Effects of Silt on Bonding strength of Clay." The speaker explained that his experiments have been conducted on synthetic sands and that apparently contradictory results had been secured on similar additions of clay to fine and coarse sands. The speaker does not favor the elutriation test methods, claiming that the results do not compensate for the labor involved, and that other methods are better. The tests were conducted with additions of 4, 6 and 8 per cent water. Answering a question of a member, the speaker stated that interesting features possibly might have been disclosed with a higher water content. Several features in the paper were discussed briefly by H. W. Dietert, J. T. MacKenzie and L. H. Marshall.

In the absence of the author, Ben Hird, Keen & Nettlefolds, Ltd., Newport, Mon., England, the annual exchange paper of the Institute of British Foundrymen "Sea Coal Effects on Sand" was presented in abstract by John Grennan, University of Michigan, Ann Arbor, Mich.

Commenting on the usually accepted effect of sea coal in facing sand the author explained how the smoke from a high volatile coal coated the face of the mold with a film of soot. His experiments were conducted on three classes of sands, namely ordinary molding sand, sharp sand and burned sand. In addition to the face coating effect, the author claimed that a coking effect is produced on the coal and the corresponding production of tar serves as a binding agent and thus increases the strength of the sand in the vicinity of the casting. Many of the claims and observations of the author were presented in table and graphic form.

An informal report on the activities of various sand committees was presented by Dr. Ries. Owing to universally prevailing conditions the work of the committees was restricted to some extent. The main subjects under consideration included: 1—Working out figures to indicate distribution of grain on sieves. 2—Short method for indicating permeability. 3—Endeavoring to find a shorter method for the fineness test.

Course Features Sand Control

USE of bonding material was the principal subject for discussion at the shop operation session devoted to the application of sand control to commercial and jobbing foundries on Tuesday. W. G. Reichert, Singer Mfg. Co., Elizabeth, N. J., presided. A. V. Leun, Bethlehem Steel Co., Bethlehem Pa., touched briefly on essential apparatus necessary for sand control. R. F. Harrington, Hunt-Spiller Mfg. Corp., Boston, pointed out that while conditions vary among different foundries, frequently it is advisable for authority in the regulation of sand control to be invested in the technical department and that it has been demonstrated that better castings and lower costs result from the introduction of this control.

William C. Ember
Jefferson Brass Foundry, Brooklyn, N. Y., and president, Metropolitan Brass Founders' association

Compression and tensile properties of molding sand is improved as mulling time is increased up to 20 to 30 minutes, while little difference in shear strength is noted for periods of 6 minutes as compared with 20 to 30 minutes, according to Paul Bechtner, American Colloid Co., Chicago. This speaker also discussed the adaptability of various bonding materials, including fire clay and bentonite, to molding sands.

Clay bond with markedly high fusion point has no advantage over that of moderately lower fusion point so far as quality of casting produced is concerned, Mr. Leun stated. The question of how fine a bonding material should be ground evoked some variation in opinion, experiences of some indicating a reduction in mold strength with an increase in fineness, others finding that a finer bond results in greater strength. F. W. Sherman, Adirondack Steel Foundries Corp., Watervliet, N. Y., was of the opinion that fineness should be regulated by the finish of casting desired, with 20 to 28 mesh suitable for average work.

A number of interesting points relating to sand control were discussed at the second shop operation course on that subject held Tuesday morning under the direction of Dr. H. Ries, Cornell university, Ithaca, N. Y., and W. G. Reichert. The session was opened with the presentation of a paper written by C. M. Hardy, Hougland & Hardy, Evansville, Ind., on sand testing by the producer. E. L. Marshall, Columbus,

(*Concluded on Page* 39)

1908—1933

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No. 35	35,000 lbs. per sq. in.
No. 40	40,000 lbs. per sq. in.
No. 50	50,000 lbs. per sq. in.
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(*Concluded from page 37*)

O., in discussing the paper stated he believed that due to differences in weathering conditions encountered in shipping a sand from the pit to the consumer, considerable differences would result in strength properties of sand at the two points. Hence, he did not favor specifications including strength, but rather would rely only on grain size and distribution, and clay content.

Several others discussing the paper agreed with Mr. Marshall's statements. Another member said that he was of the opinion that comparable sand tests could not be made until a used or dead sand of standard composition was employed with the new sand or bonding agent. The standard used sand of course, would be different for the various branches of the foundry industry. A considerable difference of opinion was indicated on the relative merits of using shear, compressive or tensile strength as a sand test. In a number of sand mulling tests from 5 to 30 minutes with sands mixed with new sand, fire-clay, and bentonite it was stated that after 5 minutes mulling, the shear values flattened out while the compressive and tensile values increased with the time.

The ability of a used sand to absorb moisture was suggested by Mr. Marshall as a test to indicate its value of using again. The sand is dried at 110 degrees Cent., weighed and then subjected to a saturated atmosphere for a definite time. It then is weighed to determine its adsorptive quality as compared to the same test on a new sand. It is said that a low adsorption indicates loss of life.

Study Sand Control

Under the chairmanship of H. W. Dietert, H. W. Dietert Co., Detroit, the subject of sand control in the foundry was considered under two heads on Thursday. The first section covered sand defects, causes and remedies. The second section dealt with improvement of surface qualities.

Relation between casting defects and various molding sand properties was illustrated on copies of a 10 x 12-inch chart distributed to the members in attendance at the meeting. The chart is divided into one single and five double columns. The first, or single column carries a list of the usual casting defects, blows, drops, scabs, cuts, rough surface, penetration of metal, cracked castings, pin holes, rat tails.

The double columns are headed respectively: Permeability, green strength, moisture, dry strength, mold hardness. Under each of these headings the double column carries subheads *cause* and *remedy*. Thus by reading across the chart from left to right the cause and the remedy for each form of defect is indicated so far as permeability, green strength, moisture, dry strength and mold hardness are concerned. For example rough surface on a casting may be due to high permeability, high green strength, high or low moisture, low dry strength or low mold hardness. The remedies advocated under each of the fore-going headings included: Reduce coarse grains, reduce clay, control, increase water or clay bond, increase ramming.

The chairman presented a running comment on each of the features and elaborated to some extent on several in answer to inquiries. Related and additional features were discussed later in a general survey dealing with methods of improving the surface appearance of castings.

The sand control session of the shop operation course Friday developed into an informal discussion of a variety of topics. Commenting on the operation of his plant, one foundry superintendent claimed that constant and close supervision is exercised over the preparation and distribution of the sand. The sand is rebonded with clay additions, but the combinations are different for floor molding, machine molding and for use with the sand slinging machine. The question of the flowability of sand provoked differences of opinion Strange as it may seem one member claimed that in certain instances sand with rounded grains showed a lower flowability than sand with angular grains.

Discuss Materials Handling

THE materials handling session of the joint meeting of the American Foundrymen's association and the American Society of Mechanical Engineers, Friday morning, was presided over by Jervis B. Webb, Jervis B. Webb Co., Detroit, representing the American Society of Mechanical Engineers.

In developing a theme on the economical application of mechanical equipment to foundries with small or intermittent output, Max Amos, Standard Automotive Parts Co., Muskegon, Mich., described the installation and operation of sand handling equipment in the plant with which he is connected. Small molds are dumped by hand into a bucket suspended from a monorail. The castings are removed by hand and the sand is dumped into a storage bin. The cooled sand is treated in batches in a muller and discharged into buckets suspended from the monorail which convey the sand to a point above any of the molding machines. Criss-cross chains attached to bars on top of the bucket by springs and to the clam shell doors or gates at the bottom, prevent the sand from arching or clogging in the buckets. New sand is added to the supply at the discretion of the operator of the sand mixer, and in conformity with the requirements of any class of castings.

The field of material handling equipment in semiproduction foundries was described in a paper presented by R. G. Wieland, Forest City Foundries Co., Cleveland. Great flexibility is required in the style and scope of equipment due to the diversity of output and lack of long running orders on duplicate castings. So far as possible the equipment should be designed to prevent any back tracking. The amount of sand to be handled daily for each molder varies to a considerable extent, but is approximately 8 tons.

In the discussion which followed attention was directed to the fact that in recent years foundrymen end equipment manufacturers have arrived at a better understanding of the suitability and application of mechanical equipment in the foundry. The meeting closed with a discussion on the relative merits of hand and mechanical charging methods for the cupola.

Session Probes Foundry Refractories

Considerable discussion developed from two papers presented at a session on foundry refractories on Tuesday afternoon under the chairmanship of A. V. Leun, Bethlehem Steel Co., Bethlehem, Pa. A paper "Cupola Refractories" by Dr. E. E. Marbaker, Industrial Research & Engineering Co., Pittsburgh, was presented by J. M. McKinley, North American Refractories Co., Cleveland. In discussing this paper W. C. Hamilton American Steel Foundries, Chicago, pointed to the wide variations in cupola practice and to the need of greater co-operation between the manufacturers and users of cupola refractories.

The second paper "Factors Affecting Service of Clay Refractories in Iron Foundries" was presented by Robert C. Zehm, the Stevenson Co., Wellsville, O. The discussion of the paper centered around the type of bricks which should be made for specific jobs, the use of monolitic linings, the quality of cupola brick that should be used, etc.

A. N. Duncan for many years connected with the sales force of the Patent Cereals Co., Geneva, N. Y. and who suffered a severe paralytic stroke last Thanksgiving, has recovered and now is covering his usual territory.

Set Up Nonferrous Association

(*Concluded from Page 23*)

York, all of Pennsylvania, other than that included in District No. 2, and West Virginia. J. F. Newman, Lawrenceville Bronze Co., Pittsburgh.

District No. 4—State of Ohio. D. D. Francis, National Bronze & Aluminum Foundry Co., Cleveland.

District No. 5—Michigan and that part of Indiana south of a line running east and west through Ft. Wayne, but including Ft. Wayne. Harry W. Holt, Bohn Aluminum & Brass Corp., Detroit.

District No. 6—Illinois and that portion of Indiana not included in District No. 5. Frank L. Hayes, Chicago Hardware Foundry Co., N. Chicago, Ill.

District No. 7—Wisconsin and Minnesota. G. B. Miller, Loeffelholz Co., Milwaukee.

District No. 8—Those States south of the Ohio River and east of the Mississippi River, except West Virginia. Charles Wegelin, Dixie Bronze Co., Birmingham, appointed pending group election.

District No. 9—Those States west of the Mississippi River except Minnesota, to and including New Mexico, Colorado, Wyoming and Montana. E. J. Thomas, Progressive Brass Mfg. Co., Kansas City, Mo.

District No. 10—All States west of District No. 9. Maurice Greenberg, Greenberg Foundry Co., San Francisco.

Elect New Officers

N. K. B. Patch, chairman of the organizing committee acted as temporary chairman during the consideration and adoption of the by-laws. A nominating committee composed of D. D. Francis, National Bronze & Aluminum Foundry Co., Cleveland; Harry W. Holt, Bohn Aluminum & Brass Corp., Detroit, and Justin A. Duncan, William Duncan Co., East Boston, Mass., was appointed to designate candidates for the offices of president and vice president to serve until the annual meeting in 1934. They nominated N. K. B. Patch for president and Allen B. Norton, Aluminum Co. of America, Cleveland, for vice president. These officers were elected unanimously.

The directors then appointed Sam Tour, Lucius Pitkin Inc., New York, as secretary-treasurer, and James B. Westcott, Chicago as council. Committees were appointed to consider a plan for accumulating the necessary statistics of the industry and to formulate a suggested code under the National Industrial Recovery act.

An adjourned session of the board held July 21 considered details of a proposed code of fair competition, matters of establishing standard costs and other factors necessary for meeting the requirements of the Industrial Recovery act.

German Founders Hold Meeting in Berlin

The twenty-second annual meeting of the Verein deutscher Giessereifachleute (Association of German Foundrymen) was held in Berlin on June 10 and 11. Papers presented included "Danger for Foundry Customs through Neglect of Protest against Uncertain Patent Claims," by Dr. Rudolf Stotz; "Foundation of Cost Accounting for Iron Foundries," by J. Petin; "Contributions on the question of Alloyed Cast Irons," by Dr. C. Pfannenschmidt; Contributions on the Primary Crystallization of Cast Iron," by Dr. Franz Roll; "The Strength of Welded and Cast Parts," by Dr. A. Thum, and "World Viewpoints and Technique," by Gottfried Feder.

Following that meeting the short-course of the Technical high school of Berlin was held on June 12 and 13 in conjunction with the Verein deutscher Giessereifachleute, Deutschen Gesellschaft fuer Metallkunde (German Society for Metallurgists) and Gesamtverband deutscher Metallgiessereien (Association of German Metal Foundries). Papers presented included "Silumin, Its Development Story," by Dr. W. Claus, "Technical Foundry Problems in the Production of Aluminum Castings," by Dr. J. Dornauf, "Design Technique of Aluminum Castings," by W. Hartl, "Zinc-alloy Castings," by E. Rossow, "Scientific Metal Foundry Methods 1923-1932," by Dr. W. Claus, "Building-up German Metal Technique out of German Materials," by Prof. W. Guertler, "Casting Testing," by Dr. W. Claus, "Nickel and Nickel Alloys," by Prof. Guertler, and "State and Development of the Pressed-cast ing Process," by Dr. W. Brunnckow. Following that meeting a symposium and demonstration of x-ray work was held in the laboratory of the Eisenhuettenmaennischen institute of the Technical high school at which several papers were presented.

A. S. M. E. Discusses Castings

GRAY iron specifications and electric furnace practice in the melting of gray iron occupied the machine shop-foundry session of the American Society of Mechanical Engineers on Tuesday morning, June 27, at the Palmer House, Chicago, under the chairmanship of W. F. Coleman, vice president, W. A. Jones Foundry & Machine Co., Chicago. A paper "Development of Cast Iron for Machine Construction," by Oliver Smalley and W. W. Kerlin, Gray Iron institute, Cleveland was presented by Mr. Kerlin. A second paper entitled "Notes on Electric Cast Iron Practice" was presented by H. H. Walther, metallurgist, Dayton Steel Foundry Co., Dayton, O.

The characteristic of gray iron castings with reference to damping was emphasized in the discussion by Mr. Kerlin. In answer to a question from the floor, he stated that the ability of the metal to absorb vibration decreases with a decrease in the size of the graphite particles, and that therefore a close grained iron will not have as good damping properties as one of coarser grain section. John Shaw of England, again stressed the advantage of employing the transverse test rather than the tensile test as a true measure of the strength of gray cast iron.

Robert E. Kennedy, technical secretary of the American Foundrymen's association, pointed to the present tentative specifications of the A. S. T. M. as providing a series of alloys of iron. The value of the products available should be impressed upon the engineer, for it does not pay to develop high strength irons unless the engineer understands the various factors which must be taken into consideration in using them. C. H. Morken, Detroit Electric Furnace Co., Detroit, stated that the electric furnace gives what may be considered a new engineering material which may be controlled carefully as to physical and chemical properties.

R. F. Harrington, Hunt-Spiller Mfg. Co., Boston, pointed out that the specifications were designed for the guidance of engineers in the selection of engineering materials and that the user should be taught to think of the foundry as capable of producing castings thoroughly reliable and sound. A number of other foundrymen and engineers took part in the discussion.

Company To Handle General Foundry Supplies

William T. Maguire has formed the Maguire Co., with offices at 642 Hanna building, Cleveland, to conduct a general business in foundry supplies and equipment. Mr. Maguire formerly was connected with the Corn Products Refining Co. in the Cleveland territory.

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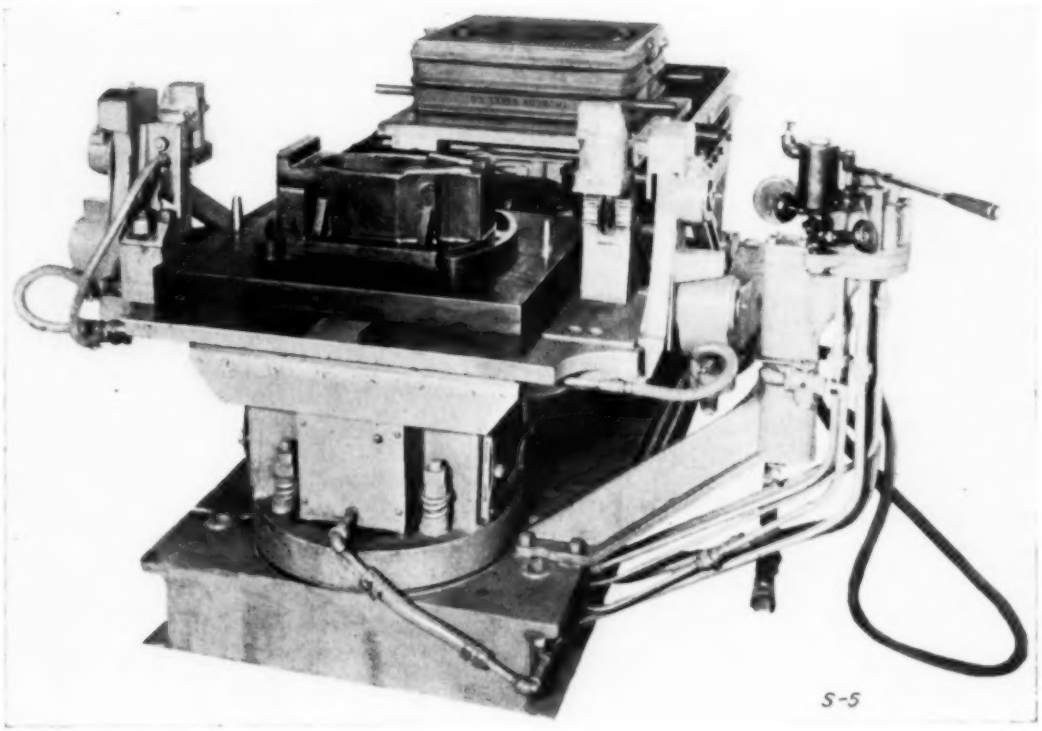

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Bulletin H-2 Gives Details

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Move Toward Industrial Codes

(*Concluded from Page* 15)

L. Seelbach, president of the Steering Committee of the Gray Iron Industry, representatives of the four agencies designated to represent gray iron, steel, malleable and nonferrous producers met to reconcile factors in codes prepared for these four branches.

The organizations represented were as follows:

Steel Founders' Society of America; Col. Merrill G. Baker, executive vice president and F. A. Lorenz, Jr., American Steel Foundries, Chicago.

Steering Committee representing the gray iron industry; Walter L. Seelbach, Forest City Foundries Co., Cleveland, president, and A. J. Tuscany, Gray Iron institute, Cleveland, secretary.

Malleable Founders' society; R. R. Fauntleroy, Moline Malleable Iron Co., St. Charles, Ill., president; Carl Gibbs, National Malleable & Steel Casting Co., Cleveland; and Robert E. Belt, secretary.

Nonferrous Foundry Association for Industrial Recovery; N. K. B. Patch, Lumen Bearing Co., Buffalo, president, and Sam Tour, New York, secretary.

To consolidate the interests of the entire foundry industry and to assure adjustment and reconciliation between the various branches of the industry, it was decided to establish the Founders' council of representatives from the various trade associations in the industry. Two representatives from each of the four branches will be elected and Dan M. Avey, editor of THE FOUNDRY, Cleveland, has been appointed secretary.

A meeting of the council was held in Washington, Wednesday and Thursday, Aug. 9 and 10 to discuss with the administration details in the matter of submitting the various codes covering the four major branches of the industry.

Book Review

Life Begins at Forty, by Walter B. Pitkin, cloth 175 pages 5 x 7½ inches, published by the McGraw-Hill Book Co., Inc., and supplied by THE FOUNDRY, Cleveland, for $1.50 and in Europe by the Penton Publishing Co. Ltd., Caxton House, Westminster, London.

This book contains exceptionally interesting reading for that great body of citizens just aproaching or having recently passed the age of forty. To many it provides a cheerful message, contradicting the theory accepted a few years ago that the fortieth milestone was a mountain in the path of every man or woman, the beginning of physical and mental decline and the doorway to the age of unfitness for work in both business and industry.

In this, youth may disagree, for the author sees a great change in the relations of youth and age. He explains how, as the world of science, technology, finance and industry grows more complex, the greater skill of the experienced outweighs in importance the superior energy of the younger person.

The employer of labor will find much of interest in this work with reference to the use of men who have passed the age of 45. The author feels that long before the dangerous age arrives when the man cannot perform the physical tasks requiring little effort of the youth, the employe should be trained in the use of his mind and his experience with the understanding that at or near forty-five he would be shifted to a job where knowledge obtained through years of experience may be applied to best advantage. In this the author believes there must be a new division of labor along natural lines.

Shows Progress in Making Chilled Wheels

Developments in design and production of car wheels since 1849 are depicted in the attractive exhibit of the Association of Manufacturers of Chilled Car Wheels, located in the Travel and Transport building, A Century of Progress, Chicago. Featuring the display is a demonstration of foundry practice in pouring a wheel mold. A ladle automatically moves over the mold and pours what appears to be molten iron into a flask which is cut away to illustrate how the metal forms the casting. Oil, water and lighting effects are used to give a realistic illustration of the operation.

Samples of typical chilled car wheels of 1849 and 1933 are available for comparison. A section cut from one wheel reveals the chili given the outer surface. Pictures of modern car wheel foundries and two murals complete the exhibit. One mural traces 100 years of progress in American railroads, the other emphasizing the importance of the chilled car wheel to railroads.

Equipment Makers Form Code at Cleveland

At a meeting of the Foundry Equipment Manufacturers association held in Cleveland, Saturday, Aug. 5, an industry code of fair competition was established for presentation by the F. E. M. A. Forty executives representing 23 companies were in attendance.

The association has designated J. R. Avey as executive secretary, with offices at 1213 West Third street, to handle matters relating to the industry under the N. I. R. A. An industry code and corollary code of fair trade practices was adopted.

The bureau of standards has published research paper No. 533 entitled "Determination of Aluminum in Nitriding Steels by the Use of 8-Hydroxyquinoline" which constitutes a rapid method for the determination of aluminum in nitriding steels. The paper may be obtained from the superintendent of documents, Washington, for 5 cents.

The St. Louis office of the Chain Belt Co., Milwaukee, has been moved from 339 North Taylor avenue to 5475 Cabanne avenue. Fitch S. Bosworth is in charge.

A demonstration of the pouring of a mold features this exhibit at the Chicago Century of Progress

European Foundry Practice

Digest of recent literature covering various phases of castings manufacture

Inclusions

Nonmetallic Inclusions in Steel Castings (Les Impuretes Non Metalliques dans les Moulages d'Acier), by Dr. Ing. F. Giolitti. *Bulletin de l'Association Technique de Fonderie*, Paris, May, 1933.

Various types of nonmetallic inclusions form two principal classes: Foreign slag particles, which are physically carried into the steel in the course of elaboration, and native slag particles, which result from reactions during melting and solidification. The latter are difficult to study, owing generally to their smallness. Some form a sort of emulsion in the steel. The author describes tests showing that solubility in liquid steel of nonmetallic inclusions, if such solubility exists, is of a low order. From this he deduces that inclusions can include only small quantities of sulphur, phosphorus and certain ferrites.

Effects of nonmetallic inclusions on mechanical properties of steel depend on several factors: Quantity of inclusions in a given volume of metal; size of particles; shape of particles and group of particles; distribution of the particles relatively to primary and secondary structure of the steel; reaction that can take place between the inclusions and the steel that surrounds them.

The fact that inclusions accumulate in those regions in which other injurious products tend to concentrate by liquation is particularly harmful in the case of steel castings, because heat-treatment is then necessary to eliminate or reduce these defects. The author puts forward a hypothesis according to which, owing to frequent changes in the equilibrium states of oxidation and carburation, particularly because of variations in the various speeds of reaction in the different phases, nonmetallic inclusions can have a decarburizing action on the surrounding metal and give rise to the formation of localized ferrite germs. These germs cause ferrite gradually to accumulate around the nonmetallic inclusions, with the resulting reduction in the mechanical characteristics of cast steel.

The author then discusses the principles on which are based the best known methods to reduce inclusions and eliminate their detrimental influence. Some factors are to be looked for in the first phases of the elaboration of the steel. It is pointed out that the action of silicon as a deoxidizer is not complete without the use of manganese. While manganese is a less powerful deoxidizer than silicon, it seems to exert an additional physical effect, making the mechanical separation of the emulsion of inclusions easier.

To eliminate, as far as possible, the effects of nonmetallic inclusions, it is emphasized to pour steel at the lowest temperature possible, to have as high a solidification rate as possible.

Phosphorus In Iron

Influence of Phosphorus on the Properties of Hardened and Tempered Cast Iron, by J. E. Hurst, the *Foundry Trade Journal*, June 18, 1933.

Properties of a series of chromium alloy cast irons, containing varying amounts of phosphorus from 0.035 to 1.56 per cent were investigated in the as-cast, stabilized, annealed and hardened and tempered condition.

In the as-cast condition, it was found that an increase in phosphorus, increased brinell hardness, modulus of elasticity, and decreased tensile strength, area of stress deflection curves and permanent set value. Specimens showed the presence of initial internal stress.

All as-cast specimens hardened to 500 brinell and over after quenching in oil from a temperature of 875 degrees Cent. Maximum hardening effect is obtained in higher phosphorus specimens and minimum in intermediate phosphorus specimens. In the hardened condition tensile strength is reduced seriously in all but the maximum-phosphorus specimens. Internal stress condition is changed completely by the hardening treatment. Tempering at increasing temperatures after hardening is accompanied by a steady reduction in brinell hardness. High phosphorus specimens retain the maximum hardness until, with tempering temperature of 600 degrees Cent., all specimens show a practically uniform hardness, whatever the phosphorus content.

Beryllium

Glucinium (Le Glucinium), by J. Laissus and P. Tyvaert. *Bulletin* of the Association Technique de Fonderie, Paris, June, 1933.

Glucinium is the metal which is more generally known in the United States as beryllium. Owing to its affinity for oxygen, it has been used to neutralize the formation of copper oxide in copper melting, to obtain copper parts having high electrical conductivity. It fixes 2.65 times more oxygen than an equal weight of magnesium, and the oxide formed is easily eliminated with the slag. In a properly-controlled melting operation, 0.01 to 0.02 per cent beryllium is sufficient, and it is used in the form of a copper-beryllium alloy containing 10 per cent beryllium, which is added to the molten metal when taken from the furnace.

An iron, beryllium, nickel alloy containing 1 per cent beryllium and 5 per cent nickel, after quenching and age-hardening, can reach a hardness of 600 brinell, and the grain size is satisfactory. Beryllium has also been alloyed with iron, nickel and chromium; and an alloy containing 1 per cent beryllium, 5 per cent nickel and 20 per cent chromium also gives a brinell hardness of 600. With 12 per cent chromium, a brinell hardness of 680 is obtained. However, chromium tends to increase the size of the grain. Generally speaking, alloys of beryllium and iron have good resistance to corrosion, provided there is no carbon present.

Beryllium also has been alloyed with copper, giving results similar to those obtained with iron alloys in regard to age-hardening, the maximum figures being secured with from 2.4 to 3.5 per cent beryllium. The general properties of the alloy have been improved by heat-treatment. The copper-beryllium alloys are nonmagnetic. The resistance to corrosion and to atmospheric elements is practically the same as that of bronze.

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I. B. F. Features Alloys in Iron

(*Continued from Page* 13)

charging, if only because it permits of a continuous stream of metal. Mr. Beech also stressed the importance of sand cooling after the knockout operation and before the sand is conveyed to the sand-preparing plant. When the sand is not sufficiently cooled, it sometimes causes explosions during pouring.

J. W. Gardom emphasized the fact that with scientific control of mechanized foundries, perfectly good castings can be obtained, although castings remain a much shorter time in the sand than was the case with old methods. To obtain such good results, proper control must be exercised. Mr. Gardom added that he preferred the use of small flasks to heavy ones; and that it is best not to pour too many castings in one flask, to keep the size of the flask within reasonable limits. G. E. France stated that there is urgent need for the discussion of the application of the subject of mechanical plant in the foundry, and suggested that special study of the subject should be made by the institute.

In a separate room, the "Report on Routine Methods for Testing Green Sands," was presented, this report having been prepared by the sands and refractories subcommittee of the I. B. F. The committee has investigated routine methods of testing green sands for moisture, permeability, and bond strength. The method recommended for moisture depends on mixing a weighed quantity of sand with powdered calcium carbide in a closed container, and reading the pressure generated through the liberation of acetylene gas.

Discuss Sand Tests

Dimensions of various test-pieces both for determining permeability and bond strength are discussed in the report. Decision as to whether the American Foundrymen's association 2-inch diameter by 2 inches long, or the British Cast Iron Research association 1.128-inch diameter by 2.256 inches long test-piece should be used is not yet decided, although there is some advantage in using a test-piece of large dimensions, especially for weak sand. A satisfactory relationship has been found between permeability and bond-strength tests made when using the different test-pieces.

Permeability may be satisfactorily measured on either the A. F. A. standard apparatus, Richardson's modification, in which pressures only can be measured, or the B. C. I. R. A. apparatus—preferably the new modified design for foundries having no gas supplies. It is recommended that the bond strength should be determined by a compression test, and while several designs are acceptable, the B. C. I. R. A. new modified design is regarded as satisfactory.

Two sessions were held on Thursday morning. One dealt with three papers on special cast-iron. The first paper, entitled "Alloyed Gray Cast-Iron," was by Dr. Ing. Carl W. Pfannenschmidt, foundry metallurgist, Humboldt-Deutz Motor Co., Cologne-Deutz, Germany. In opening the discussion Mr. Williams, emphasized the great saving in resistance to corrosion through alloying gray iron with copper. F. K. Neath, British Cast Iron Research association, referring to the addition of alloys to cast-iron remarked that almost any alloy added to cast-iron increases the mechanical properties. He stated this increase is not due so much to the alloy itself, but possibly to the effect of additions in the ladle from the point of view of deoxidation, desulphurization, etc.

Dr. A. B. Everest, alluding to the extensive reference made to the use of various alloys for improving wear, asked whether any experiments had been carried out in Germany on the martensitic types of cast-iron in which the special structure is obtained either by the use of alloys, such as nickel and chromium, or by heat-treatment. Experience in Great Britain seems to point to the fact that, for resisting straight abrasion, the martensitic-structure cast-iron seems to offer best results. In connection with the high-hardness cast-irons, Dr. Everest pointed out that many of the hardness figures shown in the paper were, in his opinion, on the low side, while much higher hardness values could be obtained. He mentioned that cylinder liners with a hardness of close on 400 were being machined regularly in Great Britain on a commercial basis.

The speaker, talking about corrosion-resisting austenitic cast-irons, referred to a statement in the paper to the effect that the addition of copper to an iron containing 12 per cent nickel results in a marked improvement in resistance to acid attack. He contended that this is illusionary since an iron containing 12 per cent nickel would not be fully austenitic, and, no matter what alloys are present, a mixed martensite-austenite structure does not give good corrosion-resistance. All the copper addition does in this case is to render the structure of the iron fully austenitic, with a corresponding improvement in corrosion-resistance, but this would be found in any other austenite-forming metal being added. Copper frequently is included to replace part of the nickel for economic reasons, but where the best properties are required, experience has shown that copper-free high nickel-chromium alloys are the best.

A. E. Marks, said that the weak point in the use of special metals for the alloying of cast-iron is the price. Since the machining of castings generally must be done easily, the brinell hardness must not exceed, say, 250, and, therefore, in cases where machinability is of considerable importance, the addition of rare alloys, especially when one considers the point of view of price, is not practicable. Carbon content is the factor to be controlled by economic methods.

Replying to the discussion, Dr. Ing. Pfannenschmidt agreed that alloying does not necessarily give much higher physical characteristics, but referring especially to the increase in the value of the rotary binding test, he said that it does allow a manufacturer to cut down thicknesses without reducing strength, even if one employs only relatively low percentages of alloys. Referring to the use of alloys in relation to facilities for machining, the author stated that experience shows that an alloy can reduce machining costs by doing away with hard spots and giving a more homogeneous structure to the metal.

Growth in Cast Iron

The next paper, by E. Morgan, British Cast Iron Research association, was entitled "Heat-Resisting Cast-Irons," and refers particularly to growth in white cast-irons, low-silicon irons, high-silicon irons, austenitic cast-irons. The author also referred to high-temperature corrosion stresses at high temperatures, and reviewed a certain number of applications of such irons.

In the discussion, Oliver Smalley, Gray Iron institute, Cleveland, emphasized the fact that it is necessary to understand exactly what one means by heat-resisting cast-irons. According to the results desired, or again, according to the various applications it is necessary to specify what type of resisting cast-iron is required. He mentioned that in the United States there are four classes of heat-resisting cast-irons, each of which answer to different requirements and have different characteristics and different methods of control and production. Once such a classification is established, the problem is simplified.

The author, in replying said that, in his opinion, each problem should be considered on its own. Referring to high-silicon cast-iron, he mentioned that one must be careful with regard to the composition of such irons; and he pointed out that when high-silicon irons fail, they fail more rapidly than other irons differently constituted.

The third paper was the American exchange paper, by F. B. Coyle, International Nickel Co., New York, en-

titled: "American Progress in the Use of Alloys in Cast-Iron." An abstract of this paper was presented by Vincent Delport, European manager of THE FOUNDRY. It gave a review of the developments of alloy cast-irons in the United States and Canada in recent years, with their properties and applications.

The discussion was opened by Oliver Smalley, who said that in studying the question of alloy cast-irons one should start with a sound basis, which is the complete knowledge of the physical properties of gray cast-iron. It also is necessary to start with a proper definition of gray cast-iron, and to know exactly what one has in mind by that term.

The speaker stated that in America, gray cast-iron has given as much as 134,000 pounds per square inch tensile strength, but that applied to the American definition of cast-iron. He emphasized the fact that adding alloys to cast-iron affects the graphite mechanically, and when the point is reached where graphite is unaffected, the alloy is of no more use as a strengthener.

Justify Use of Alloys

Dr. Everest agreed with Mr. Smalley that several of the results presented in the paper could be obtained by other than the use of alloys, but, in the speaker's opinion, the use of alloys is still well justified when it enables a foundryman to obtain the results without resorting to other more complicated and perhaps inconvenient methods. Furthermore, in many of the applications, the use of alloys has definitely presented the foundry industry as a whole with types of cast-iron which have not hitherto been available. This applies particularly to alloy cast-irons used for cylinder liners. Referring to the question of high-strength cast-irons, Dr. Everest laid stress on the statement given in the paper that by a combined nickel and silicon treatment of cast-irons, high strengths can be obtained. Examples confirming this fact could be seen at the recent foundry exhibition in London. A test-bar of an iron treated with nickel and silicon had shown a tensile strength of 70,000 pounds per square inch, representing the iron *as cast* direct from the ladle and not subsequently treated in any way. It has been found that such iron heat-treated would give a strength approaching 89,000 pounds per square inch.

Referring to white and chilled irons, Dr. Everest said that in an ordinary white iron there are essentially two constituents, cementite and pearlite, having brinell hardnesses of 700 and 250 respectively. By the use of nickel it has been found that the pearlite constituent can itself be hardened up to a figure approaching 700, thus considerably increasing the ultimate hardness of the original white iron. Referring to the application of such irons to chilled rolls, the speaker mentioned that a word of warning is necessary, as chilled rolls still present many problems, although a great deal of progress has been made, and it would still be unwise to suggest that the full advantage of the alloy additions could be achieved merely making the addition suggested.

In closing the discussion, the president commended the paper for its usefulness, and expressed the thanks of the meeting to the author and to the American Foundrymen's association.

At the other session three papers were presented, one being entitled: "Anodic Treatment and Dyeing of Aluminium Castings," by N. D. Pullen. The author stated that the phrase "anodic treatment" as applied to aluminum and its alloys is, as far as Great Britain is concerned, almost synonymous with the process invented by Dr. Bengough, and his co-workers, although, strictly speaking, it refers to any process in which the material to be treated is made an anode in a suitable electrolyte under an applied electromotive force. The processes readily can be divided into three groups: (1) Chromic-acid group, of British origin; (2) sulphuric-acid group, of American origin; (3) Oxalic-acid group, of German origin. The next paper, by W. R. D. Jones, department of metallurgy, University college, Cardiff, described "Coking Practice in the South Wales District."

The French exchange paper, by V. Bernard, technical manager of the Rosieres Foundries, also was presented at this session, the title being: "Time Studies in Foundry Work." This paper was of considerable interest and gave three examples of determining the time necessary for executing given work. The examples given were: (a) gypsy pots, considered as individual work; (b) flat castings on hydraulic machines, executed collectively by gangs of six men; (c) time study on hand haulage over narrow-gage tracks.

On Wednesday, and Thursday afternoon members were conducted on a number of visits, including The British (Guest Keen Baldwin) Iron & Steel Co., Ltd., where what is claimed to be the largest blast-furnace in the British Isles was inspected; John Williams & Son (Cardiff), Ltd., which included the foundry and the window frame factory; the steel foundry and chain manufacture of Brown, Lenox & Co., Ltd.; and the steel, iron and brass foundries of the Powell Duffryn Steam Coal Co., Ltd. Visits also were paid to the tobacco works of W. D. & H. O. Wills, Ltd., and The Bristol Aerodrome.

The general organization of the conference itself deserved full commendation; and in addition to the president, C. Edward Williams, who took an active part in the organization, those mainly responsible were: William Williams, chairman of the conference committee; W. E. Clement and J. J. McClelland, respectively president and honorary secretary of the Wales, Monmouthshire and West of England Branch; T. Makemson, general secretary of the institute.

Publishes Report On Foundry Accidents

National Safety council, 20 North Wacker drive, Chicago, has published a pamphlet entitled "Accidental Injury Rates in the Foundry Industry, 1932." The report indicates that the steady improvement in accident experience recorded in the foundry industry since 1926 did not continue during 1932. The frequency rate for all types of foundries increased 6 per cent and the severity rate was up 14 per cent in comparison with 1931. These increases occurred in a year when there was further sharp curtailment of operations as indicated by a 37 per cent decrease in hours worked by plants reporting both in 1931 and 1932.

The honor roll for 1932 includes the following companies: National Brass Co., Detroit; U. S. Aluminum Co., Detroit; Dodge Mfg. Co., Mishawaka, Ind.; American Manganese Steel Co., Chicago Heights, Ill.; Mackintosh-Hemphill Co., Pittsburgh; Lycoming Mfg. Co., Williamsport, Pa.; National Radiator Corp., New Castle, Pa.; and James B. Clow & Sons, Coshocton, O.

Gives Methods for Testing Foundry Sands

Department of commerce, bureau of standards, Washington, recently published a letter circular entitled "The Properties and Testing of Foundry Sand." Much of the information presented in the circular was obtained in the bureau's co-operatitve studies carried out with the American Foundrymen's association. Information includes an introduction, and a discussion of the general properties of molding sand, the determination of the properties of molding sand, grading and choice of sand, and a selected bibliography.

Firm Celebrates Fiftieth Anniversary

Frederic B. Stevens Inc., Detroit, is celebrating the fiftieth anniversary of its founding, the company having been organized in Detroit in 1883 by Frederic B. Stevens, the present president of the organization. The firm maintains branches at New Haven, Conn., Erie, Pa., Indianapolis, Windsor, Ont., and Toronto, Ont.

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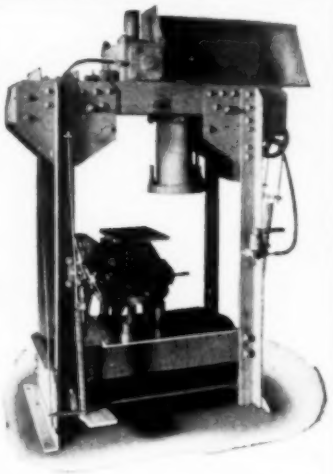

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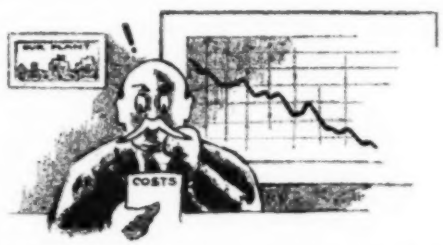

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•1

Small Cupola Handles Rush Jobs

(*Concluded from Page 22*)

suit the difference in size. The combined load to be supported when the cupola is charged is about 1 ton. The first or experimental lining was made up of ordinary fire brick set on end and with the wide face on a radial line. The spaces between the bricks were filled with a cupola fire clay mixture. This lining burned out at the melting zone in six heats. Probably a tightly packed lining of wedge brick would have given more satisfactory service. Lacking a supply of wedge brick, a second lining was made up of a quantity of carborundum fire sand usually kept on hand for lining oil furnaces.

This sand was mixed in the proportion of 5 parts fire sand to 1 part fire clay and moistened with dilute sodium silicate. The mixture was rammed solidly around a 12-inch diameter wood plug in the lower drum only, and in the space above the tuyeres. The hearth or crucible first was lined with brick. The top drum then was placed in position, lined with brick, the plug burned out and the lining thoroughly dried with a coke fire. After 10 heats this lining has not burned back more than ½-inch at the melting zone, and the cupola sometimes is kept in blast for 1½ hours.

A wood scaffold with two platforms, one at a height of 3½ feet and one at a height of 7 feet, and connected by suitable steps, serves as a charging platform. The side next the cupola is protected from the dump by an iron plate. The dump is so small that no trouble from burning has been experienced. The entire installation is in the center of the foundry under a 30-foot roof and the sparks and flames are harmless. The highest flame, when the heat nearly is over, is only about 5 feet, and this flame of course only is in existence for a few minutes before the bottom is dropped.

Experience indicates that regular foundry coke broken to a size not over 2 or 3 inches yields the best service. Iron is charged in 90-pound lots with 10 pounds of coke between each pair of iron charges. The coke bed is carried 18 inches above the tuyeres. The iron in the charges is broken small with a maximum weight of about 10 pounds for gates and sprues tumbled clean, and miscellaneous scrap. No trouble has been experienced from bridging. Occasionally the stock hangs up for a minute or two. A few blows on the top charge with a bar usually frees the material immediately.

The slag hole extends through the lining and shell about 1-inch below the tuyere level and at a point opposite the tap hole. With charges up to 750 pounds no necessity exists for opening the slag hole. After the fourth or fifth charge a few lumps of limestone are added to each charge to flux any dirt or ash from the coke.

In melting metal for rush jobs, breakdown castings and regular work, this little cupola has more than paid for the cost of installation. In many instances chills are poured in the morning for use in molds poured from the regular big stack in the afternoon. The iron comes down hot and the ratio of bad castings to good is no greater than where the iron is melted in the regular manner in the large cupola.

Phosphorus in Iron

(*Concluded from Page 18*)

others. However, the careful work of Spencer as presented in the *Transactions* of the American Foundrymen's association 1931, has shown that when the pouring temperature is kept the same amount above the freezing point, the effects of high phosphorus are not noticeable. In other words the fluidity imparted by phosphorus is due directly to its effect in lowering the freezing point.

Second, as is well known, alloys which freeze over a range of temperature as high phosphorus irons do, usually tend toward segregation. The actual liquation of high phosphorus globules, resembling *tin sweat* in nonferrous alloys, has been mentioned. Many years ago American automotive castings manufacturers ran into trouble with shrinkages and porosity due to use of high phosphorus irons.

As a result most American cylinder blocks and similar castings now are made with phosphorus content below 0.25 per cent and even below 0.20 per cent. After a careful series of tests on a heavy solid block and a complicated casting, W. West in the *Foundry Trade Journal*, Jan. 12, 1933, concludes that due to "an extended range of solidification (phosphorus)—becomes responsible for defects such as draw holes and sponginess in castings of varying section thickness." He recommends that phosphorus content for pressure castings of noniform section be kept under 0.30 per cent.

(b) Phosphorus has some effect on carbon pickup in melting. Wust's work showing the reduction of the eutectic percentage of carbon has been referred to previously and Stead had demonstrated the same thing a few years previously. MacKenzie in the *Transactions* of the American Foundrymen's association—1925, conducted an elaborate series of investigations under actual foundry operating conditions and confirmed the work of Stead and Wust in a practical way.

(c) Phosphorus up to say about 0.70 per cent does not affect materially the tensile and transverse strength of ordinary gray iron (say those classes normally 35,000 pounds per square inch tensile strength or below). In high percentages it is decidedly detrimental to strength. For example a carefully made iron of carbon 3.25 per cent, silicon 2.08 per cent (steel scrap used 13 per cent) which with low phosphorus ordinarily should run 30,000 pounds per square inch or above tensile ran only 21,300 pounds per square inch, when phosphorus was 1.99 per cent. Hamasumi as recorded in *Scientific Report* Tohoku Imperial university, Vol. 13, 1924, tested a series of irons of approximately constant silicon content (1.57 to 1.89 per cent) with phosphorus varied from 0.026 to 5.095 per cent. He found slight increase in strength up to 0.30 per cent phosphorus and a steady decrease beyond. He found the strength reduced about one-third at 1 per cent phosphorus.

This is the first of two articles on the effect of phosphorus in cast iron. The concluding article will be presented in an early issue.

THE EDITORS.

Foundries Required To Make Flour Inventory

The new wheat processing tax covers flour and other materials containing wheat used as foundry molding material or core binder. The Internal Revenue service requests that all foundries having flour or other wheat products on hand are required to make an itemized inventory of floor stocks of such taxable wheat products on hand July 9, 1933. This return is being made by millers, bakers, hotels, etc., and will include foundries. The return should be made on PT form 41 and should cover all taxable wheat products received for replacement in the 30-days period following July 9, and the return should be filed not later than 30 days from inventory date which is given as Aug. 7, 1933.

Failure to file inventory entails a penalty of 25 per cent of the amount of tax to accrue. Foundry molding flour is taxed at 0.396c per pound.

British Group Plans September Meeting

The autumn meeting of the British Iron & Steel institute will be held in Sheffield from Sept. 12 to 15. The list of papers to be presented at that meeting will be published later.

At the time of the meeting, the principal steelworks of Sheffeld and Scunthorpe will be visited.

Cast Steel in Europe and America

(*Continued from Page 20*)

produce some of the finest looking castings introduce the aluminum into the metal stream between the ladle nozzle and the pouring cup. Captain Shane was surprised to find results so nearly alike from such a wide variation in deoxidizing technique.

In conclusion Captain Shane considered that one thing necessary among American steel foundrymen is a change in mental attitude. They think navy specifications are too severe, that these standards are not necessary. They think that annealing is not necessary. Too much attention is given to quantity production and not enough to quality.

Since his return he has visited a number of steel foundries in the United States and has been encouraged by a real change from the attitude which prevailed a few years ago. Many foundries definitely have adopted metallurgical control. Many plants are up to date and employ scientific methods. However, managers of many large plants have not yet seen the light. They do not understand that in these days of limitation of displacement of naval vessels it is imperative that castings be made as light as strength requirements permit.

American Shops Modern

P. E. McKinney, metallurgical engineer, Bethlehem Steel Co., Bethlehem, Pa., in discussing the paper, claimed that Captain Shane's open minded and unprejudiced review of the results of his inspection trip to various European steel foundries discloses no fundamental features of physical equipment or facilities possessed by foreign industries that are not available in the United States. The national workshop probably is more modern and up to date than that of Europe and is at the disposal of steel casting consumers.

Unfortunately the average consumer's conception of a steel casting goes no farther than the material as shown by the chemical and physical properties. In the event of casting failure through any cause, the first temptation is to try an exhaustive series of chemical and physical tests and then insist upon improved physical properties through the use of alloy additions or elaborate heat treatment, without even questioning whether the design imposed on the foundryman has made production of a satisfactory casting impossible.

Constructive criticism offered by the foundryman either is ignored or met by the taunt: "This is the foundryman's problem. If he is not sufficiently skilled to produce castings from the patterns submitted, other foundrymen will accept the job."

The mental attitude of many designers is that of resentment to constructive criticism from the foundrymen, according to Mr. McKinney. Minor concessions occasionally are yielded apparently on the assumption that they are necessary to overcome shortcomings on the part of the foundryman or his equipment, rather than that the original design may have been fundamentally unsound.

It was Mr. McKinney's privilege to study carefully quite a number of photographs and sketches of castings in various stages produced by one of the largest steel foundries in Europe, a foundry which enjoys a world wide reputation. In the subsequent discussion he found that before the design of the castings was approved, numerous conferences were held between foundry and customer representatives. In one notable instance preliminary work involved visits of interested parties to a foreign country, development of plaster casts for some of the forms and other studies never dreamed of in this country. If an American foundryman suggested the advisability of any of this kind of work, the customer immediately would set it down to ignorance of his business.

Quoting a typical instance Mr. McKinney claimed that the design for the entire lot of castings for a prominent American consumer was completed without consulting any practical steel foundryman or foundry engineer. The original intention was to consult the foundries regarding methods they might desire followed in construction of the patterns. On account of preliminary delay, pattern production had to be expedited. The work was divided among several pattern shops, presumably familiar with iron and nonferrous metals, but none specialists in steel foundry practice.

The resulting patterns were accepted by the foundrymen who did the best they could under the circumstances. Defects disclosed on machining, also failure of some of the castings in service were accepted by individuals not familiar with all the circumstances as indicative of poor foundry technique.

Referring to the accident during the erection of the Quebec bridge Mr. McKinney claimed sight should not be lost of the fact that the design of the cast steel supporting shoes originally used was abandoned and wrought steel keys of fundamentally different design were substituted before the final erection. Engineers generally have conceded that the original design involving an assembly of cruciform castings was unsatisfactory. Also, since the castings lie at the bottom of the St. Lawrence river, no proof ever has been adduced that the castings contained internal or hidden defects in composition.

High quality castings are produced in every foundry where close co-operation exists between designers and foundrymen. At the naval gun factory operated by the navy department, bureau of ordnance, close co-operative work between designers, foundrymen and patternmakers has made possible the development of light weight steel castings for ordnance mounts for naval cruisers that compare favorably with castings produced here or in any foreign country.

Commenting on the criticism of fast melting Mr. McKinney stated that duration of the melting cycle is no criterion of the quality of the steel. With high grade materials, plants operating on short cycles produce steel for the purpose intended equally satisfactory, to that of other plants operating on long cycles. The object of any steel manufacturing process is to carry the raw materials through the successive stages of melting and refining, to finish the metal in a properly deoxidized condition and at the proper temperature for the work in hand. Details of these operations vary and can be accomplished successfully only under scientific control. In this respect American steel foundries are on a par with those of any country.

Casting Industry Handicapped

The American steel casting industry in many respects is handicapped seriously by the requirement of rule of thumb specifications covering physical characteristics which in many cases fail to realize the difference between castings of light and heavy section, or the nature of the stresses to which the casting may be subjected in service according to Mr. McKinney. In many instances this necessitates subordinating fluidity and casting properties to a factor of minor consideration and greatly restricts the foundry metallurgist in his selection of the most suitable type and composition of steel for producing a sound, finished casting. It would appear that foreign foundrymen enjoy greater freedom in this respect.

Mr. McKinney could not agree with the statement that the rate of cooling is more important than the rate of heating, nor could he concede that a slow furnace cooling operation is the only proper method for heat treating all types of steel castings. While it might be suicidal to treat by drastic cooling or even normalizing a large casting having a great variation in section, the same treatment may be the best for a small casting of the same composition.

With the increasing use of alloy steel castings, elaborate heat treating processes adapted to any particular job are being developed in this country.

(*Concluded on Page 51*)

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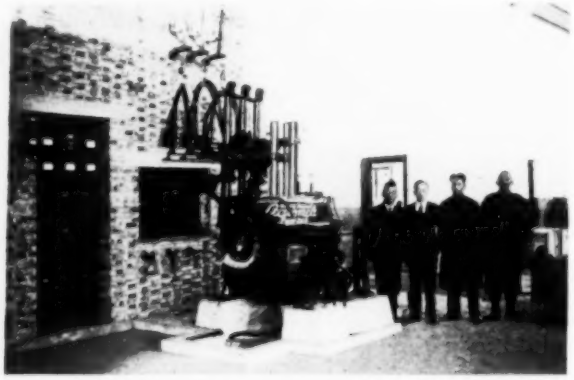

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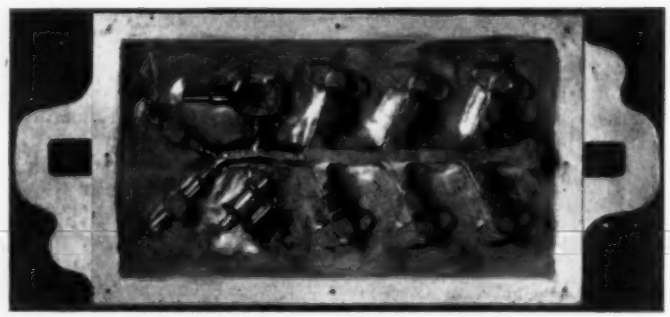

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(*Concluded from Page 49*)

They are subject to the same scientific control exercised on other alloy steel heat treatment problems. Demand for special castings for high speed, light traction equipment, motor trucks, etc., has resulted probably in a greater development of special heat treatment technique in America than exists in Europe.

Majority of present day development is in connection with quantity production of practically similar size and design castings, but there is no reason why with the intelligent application of engineering knowledge, these developments cannot be carried into the field of jobbing castings to the same extent as already has been accomplished in the forging industry.

This is the first of a series of articles dealing with a paper and subsequent discussion on steel casting technique in Europe. The second article will appear in an early issue.

THE EDITORS.

Core Assembly Handled as a Unit

(*Concluded from Page 12*)

core into place. Part of the upper print rests in a corresponding recess in the large center core. A covering core which extends over the full length of the casting at each side engages a shoulder on the upper end of each barrel core and locks the entire set firmly in place.

After the core assembly has been made up, the end frame on the jig shown in Fig. 4 is removed and the aluminum jig shown in Fig. 2 is placed in position over the cores. Two long ¾-inch bolts are lowered vertically through holes in the top of this jig and through corresponding holes in the center core. Both ends of the bolts are threaded. The lower end of each bolt is screwed into a nut in the slab or base core of the assembly. A nut on the upper end is tightened down on the jig girder. In this manner the entire weight of the core assembly is carried by the two bolts. The bolts in turn are suspended from the girders or arched members of the jig. A twin chain hooked to eye bolts in the end of the jig and suspended from a small power hoist is employed to lower the core assembly into the mold as shown in Fig. 2.

Simple Pattern Equipment

In contrast with the extensive and elaborate equipment required to form the cores, the pattern equipment for making the outside part of the mold is comparatively simple. The drag pattern is shown in Fig. 7; the cheek pattern in Fig. 8 and the cope pattern in Fig. 9. Each of the patterns is mounted on a substantial iron plate and the molds are rammed on jolt roll-over machines made by the Osborn Mfg. Co., Cleveland. The drag is the only part that is rolled over. Large, loose, dovetailed core prints at the ends of the cheek pattern are removed after the cheek is rammed and then the cheek part of the mold is lifted from the pattern. The cope is almost flat and therefore may be lifted directly from the plate.

Method of conducting the metal to the gates also is shown in Figs. 7, 8 and 9, supplemented by a cross sectional view in Fig. 6. Iron is poured simultaneously from two ladles on opposite sides of the flask into dry sand basins. Two of these basins are shown at the extreme right in Fig. 1. Any dirt or scum on the metal is caught by a dam in the basin. The clean iron flows under the dam and then rises in the smaller of the two chambers before it enters the sprue.

Force of the falling metal is checked at the joint of the cope and cheek where the metal travels about 10 inches in a horizontal direction before it drops through a vertical sprue in the cheek. At the joint of the cheek and drag the metal again takes a horizontal direction in a channel over a perforated core. After passing through this core the metal flows through two channels to a long horizontal passage communicating with the seven ¼ x 2-inch flat gate openings in the foundation core.

Method of placing four risers approximately at the upper four corners of the casting, is shown in Fig. 9. Any danger of dust or other foreign material entering the mold through the riser is prevented by a short horizontal step which connects the bottom opening of the riser with the machining strip on top of the casting. These risers merely serve as *show-ups* to indicate when the mold is filled and probably may be eliminated in an operating program which constantly seeks further improvement. The fifth, or central member of the upright group connected to the long horizontal member is the device for forming a vent channel over the central cores in the casting.

To Engage in Consulting Practice

Major R. A. Bull has terminated his connection with the Steel Founders' Research group and expects to engage in private consulting practice. He will maintain headquarters at 541 Diversey parkway, Chicago.

Studies Literature On Alloys Used in Iron

Alloys of Iron Research of the Engineering Foundation recently issued a review of its activities since it was organized late in 1929. The work of the group has progressed to the stage where most of the important publications in English, German, French and Swedish from 1890 to date have been studied thoroughly and data of importance abstracted and classified. The files of the organization contain more than 12,000 critical abstracts of nearly 5000 technical papers.

A comprehensive review of the literature of the world was made primarily to be used as a basis for a series of monographs on alloys of the element iron with 38 of the 92 chemical elements. The first monograph, *The Alloys of Iron with Molybdenum*, was published late in 1932 and covers the manufacture, properties and use of the alloy in cast iron, cast steels and rolled steel.

The second volume of the series, *The Alloys of Iron and Silicon*, will be published in the near future and will contain a critical resume of all data on steel and cast iron containing silicon as an important alloy.

Electric Metal Makers Form Guild

An association, to be known as the Electric Metal Makers guild, recently was organized at a meeting in Chicago. H. B. Schulz, superintendent electric steel, Illinois Steel Co., South Chicago, Ill., was elected president; A. E. Kayes, International Nickel Co., Huntington, W. Va., vice president; Joseph A. Scott, Driver-Harris Co., Harrison, N. J., secretary-treasurer.

By-laws were proposed at the meeting, amended and approved. The new organization is an association of individuals, and application for membership may be made to any officer.

Elects Officers

Dr. William E. Wickenden, Case School of Applied Science, Cleveland, was elected president of the Society for the Promotion of Engineering at the society's recent convention at Chicago. Other officers chosen were Prof. F. V. Larkin, Lehigh university, Bethlehem, Pa., and Dean B. M. Brigman, University of Louisville, vice presidents; Prof. F. L. Bishop, University of Pittsburgh, secretary, and W. O. Wiley, New York, treasurer.

The Detroit Foundrymen's association held its third golf tournament on Thursday, July 20, at the Meadow-Brook Golf and Country club.

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THE Griffin Hot-Blast Process reduces coke consumption more than 25 per cent, permits the safe use of more scrap in the charges, improves the melting and pouring practice at every stage from start to finish, promotes safety, assures greater uniformity and better quality of the finished castings and greatly reduces rejection losses.

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The boss seems to have his doubts

The Adventures of Bill

BY PAT DWYER

AS A MAN in touch with current events," Bill said to me the other night, "have you any theory to account for the epidemic of debating clubs that has broken out like a rash over the educational face of the country recently? Every paper you pick up carries an item about two opposing teams locked in a deadly struggle over the relative merits of town or country life, marriage or single blessedness, the mountain or the sea shore, blondes or brunets, or some equally insoluble problem that would not amount to tuppence ha'penny, even if it was settled."

"I should not like to get tangled up in a debate with you," I said. "You are too careless in the choice of words and you calmly present assumptions that have no basis in fact. For example, what authority have you for stating, 'Every paper you pick up, etc.?' 'Tis true I read a few papers now and again, some through choice and others through necessity, but I have noticed no reference to this debating plague which you claim has the country in an iron grip, vampire like sucking the life blood from the very vitals."

"For a lad who has not been reading the papers, a blinkin' blighter who wilfully missconstrues my plain statement, you seem to have a fairly good grip on the essential features. However, what I started out to say, or rather what I was leading up to was that it is a wonder some of these clubs do not introduce an original subject. Cut out these useless and long winded battles in which the wordy warriors hurl pinched extracts from the encyclopedia at each other. Give 'em a good juicy subject into which to sink their teeth—"

"Ah! I see. Fling tomatoes, grapefruit and what not at each other, eh? Fine! I get the idea."

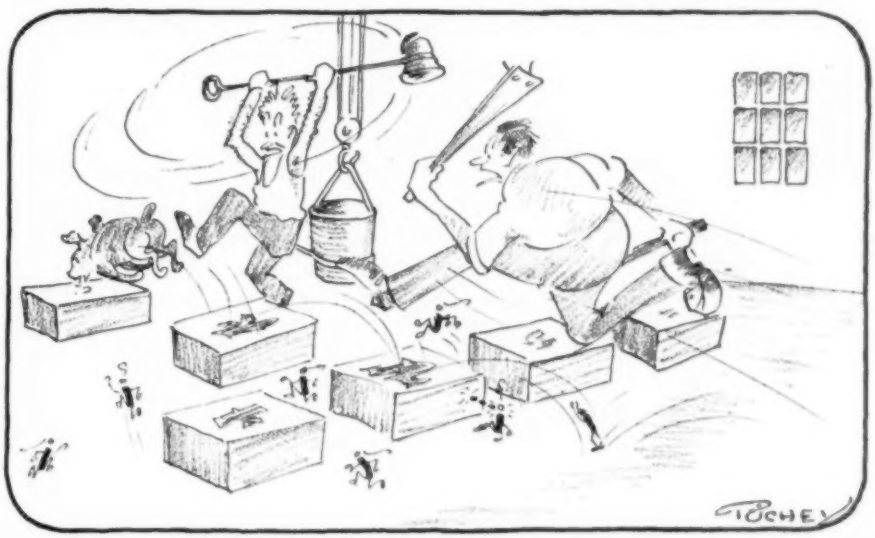
"I'd like to dot you one with a good ripe tamatta right now!"

"Steady all! Stand by to go about. Perhaps—although it seems too much to expect—perhaps you have a subject in mind. One that is not hackneyed. A subject that is—as you so neatly put it—good and juicy, into which the old fangs may be driven with a certain amount of vim and vigor."

"And how!" Bill remarked complacently. "I would have two hand picked teams debate violently. 'Resolved that the farmer can present a better alibi than the molder for a defective product.' "

"At one time or another I have heard fearful, wonderful and ingenious excuses offered for defective castings, but even the most brilliant mind cannot compete with the forces of nature. In a debate of the kind you have in mind, the farmer has all the cards stacked in advance. In addition to the hazards incident to the presence of the human factor, he is aided and abetted by all the natural and supernatural forces. He can blame hail, rain, snow, early frosts, cut worms, jiggers, corn borers, caterpillars, grasshoppers, lightning, sour soil, lack of googum in the fertilizer, and at least 47 other factors over which he has no control. Of course, as I said before, the molder is an exceedingly ingenious individual in oozing out of a slippery corner, but in adopting the negative in 'Resolved that the farmer can present a better alibi than the foundryman for a defective product' he would have no more chance of winning a decision than a rabbit would have in playing hop-scotch with a kangaroo."

"Well," said Bill, "I'll tell you. Although you show some of the wild kangaroo strain in jumping to conclusions, I hardly can blame you in the present instance. As a party of the first and also as a party of the second part, I have heard and presented many excuses for defective castings. Based merely on personal experienc, my views would coincide with your's on the utter futility of comparing the molder's excuses with those of his agrarian brother. However, through the kindness of T. H. Williams, Jersey City, I now have a list of excuses for bad castings that will mow down these farmer lads as grain falls before the reaper, or, as the late brother Byron puts it so



The foundryman's life is just one little thing after another

neatly in the *Siege of Corinth*: 'Even as they fell, in files they lay, like the mower's grass at the close of day.' Just throw your eye—well, both eyes if you like—over this noble list."

For the reader's benefit, a possible weapon of offence or defence, a copy of this truly remarkable document is reproduced in the accompanying box.

"The fiendishly ingenious feature of these excuses is that they carry just sufficient truth to make them plausible. Only a boss on the job at the particular time one of the excuses is presented can determine whether it is acceptable or not. Undoubtedly rotton sand or bum facing may be responsible for a defective casting. The same is true of dull metal, dirty metal, metal that is too hot or a burned out flask. However, in each of these cases and in front of a competent examiner the excuse maker is faced with a second question, viz.: With all this fore-knowledge why did he not either refuse to use the materials, or, file a formal protest before using them?

"Some of the excuses certainly lie outside the molder's scope of influence. Manifestly a man cannot stand guard night and day to prevent stray dogs from running over the molds or rats from playing hide and seek up and down the risers. He has no command over the breezes that blow in through the broken windows and carry a stream of loose sand down the gates. Laborers have been known to knock clamps from molds and also to fall over them and they hardly can be expected to learn English in a day. Cross eyed cats, blowing chaplets and swab pots that cannot stand upright constitute afflictions almost as hard to bear as shops that are too dark, shops that are too light, or metal that comes too soon or too late . When all else fails the molder can fall back on the good old standard, 'Well, the boss did not tell me.'

"Speaking about farmers, telling people things and one thing and another reminds me of an inquiry I had from a man who was interested in the manufacture of plows.

"This citizen wrote me that he would appreciate information on the best and latest methods for molding and casting mold boards for plows. How is the carbon deposit removed from the face of the chills and how is the face resurfaced to give the chill renewed life. What is a suitable mixture for a 3000-pound charge in the cupola.

"If this inquirer knew nothing at all of the subject, his question would entail a long and elaborate answer covering many related features. However, from his reference to chills and carbon deposits it is apparent that he is familiar in a general way with the production of these castings. This simplifies the answer and incidentally reminds me of the simile used by Basil Lajeunesse, the ci-devant blacksmith in *Evangeline*. Extolling the many advantages of his Louisiana ranch over the Acadian home land from which he and his compatriots had been evicted in a shameful manner he said: 'Sweetly the plowshare runs through the soil as a keel through the water!'

What Every Molder Knows

Dull metal
Bum facing
Dirty metal
Rotten sand
Chaplet blew
Core blew up
Metal too hot
Shop too dark
Shop too light
Metal too hard
Cores too hard
No vent in cores
Flask burned out
Plumbago no good
Bars in cope loose
Blue Monday, Jinks
Boss didn't tell me
Pattern was warped
Metal came too late
Metal came too soon
Rat went down riser
Laborer fell over mold
Metal ran down rat hole
Dog walked across mold
Pattern was made wrong
Too much flour in cores
Wind blew dirt down riser
Laborer knocked off clamp
Swab pot fell over on mold
Boss didn't tell me to cut gate
Laborer couldn't talk English
Boy didn't skim metal enough
Cross-eyed cat ran over the mold
Boss didn't give me enough metal

"Can you imagine anything sweeter than the sight and smell of the fresh turned earth flowing smoothly from the curving side of a shining mold board?"

"Well," I admitted "the rumor has drifted into the old bailiwick—you know how rumors drift—that a certain measure of pleasure may be derived from listening to a person who sticks to one subject. However—"

"The old straight and narrow, eh? I'd hate to have a one track mind like that of some of the unfortunate creatures in the immediate vicinity. Since your creaking, rusty old mental apparatus will not permit you to follow me in an occasional little flight of fancy I shall confine my further remarks strictly to the subject and, so far as possible, cut the words down to one syllable. And what do you think of that, little Lord Fauntleroy?

"Mold board castings which must be both hard and tough to stand up under severe service conditions are poured from a low silicon iron mixture containing approximately 10 per cent charcoal iron. The mixture may be made up in many ways, depending on the available material on hand to conform to the following approximate analysis: Silicon 1.00 per cent; sulphur under 0.10 per cent; phosphorus 0.30 per cent; manganese over 0.80 per cent. A typical mixture for a 3000-pound charge might contain 10 per cent steel scrap, 300 pounds; 10 per cent low silicon charcoal pig iron, 300 pounds; 40 per cent No. 2 foundry pig iron, 1700 pounds; 40 per cent shop scrap, 1700 pounds.

"The mold is made flat on the floor in the usual manner and then turned up on edge to receive the molten iron. The drag part of the mold is an iron plate on which one side conforms to the shape of the mold board pattern while the lower side is hollowed out roughly to give approximately the same thickness, 1½ inches, of metal in every part. The gate is formed permanently in the drag, but the sprue and runner are formed in the sand cope in such a manner that the iron enters the casting at the lower edge when the mold is in pouring position.

"The face of the chill or drag is provided with prints for the bolt cores and in addition is scored all over with a number of light lines about 2 inches apart at right angles to each other. The purpose of these lines is to hold the iron as it commences to congeal, close to the face of the drag and thus prevent hollow spaces on the face of the casting.

Impressions left by the lines afterward are ground off in the finishing department. Immediately after the castings are poured, they are shaken out and buried in hot sand in brick lined pits where they are allowed to cool for 36 hours.

If by removing the carbon from the face of the chill, reference is made to a carbon deposit from the oil, the answer is that a lower quantity of thinner oil should be employed. Only a thin film is required to prevent adhesion of any moisture. This thin film is volatilized by contact with the molten iron. However, under certain conditions a thin carbon deposit may be built up. The best way to remove this deposit is by blasting.

"Grinding or other tools should not be applied to the iron face of the mold. They destroy the skin. The metal underneath deteriorates rapidly in service. The molds are used continuously until they warp or crack. Then they are thrown back into the cupola and remelted as part of the charge. Since the surface has been oxidized or burned to a certain extent in the course of a fairly long life, the iron can not be rated as first class scrap.

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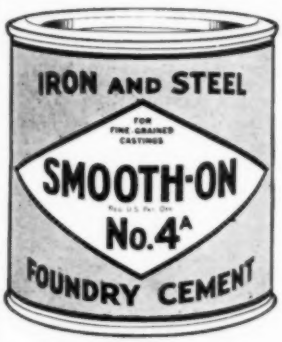

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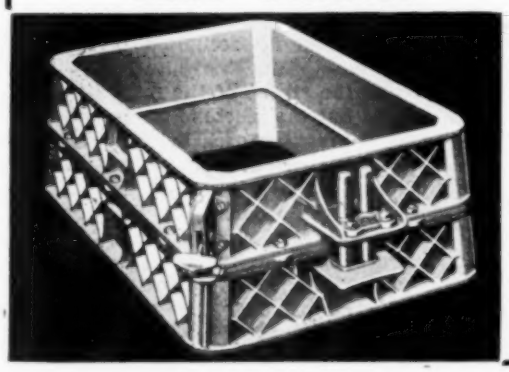

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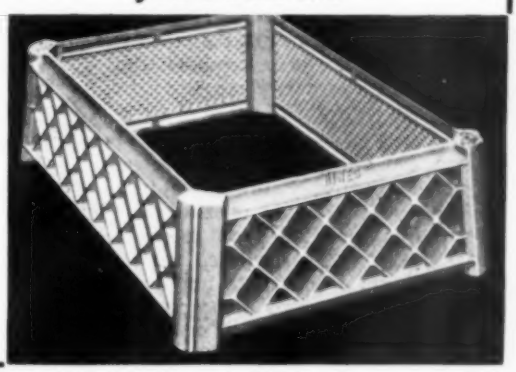
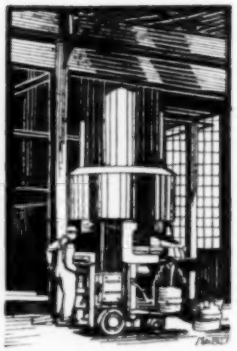


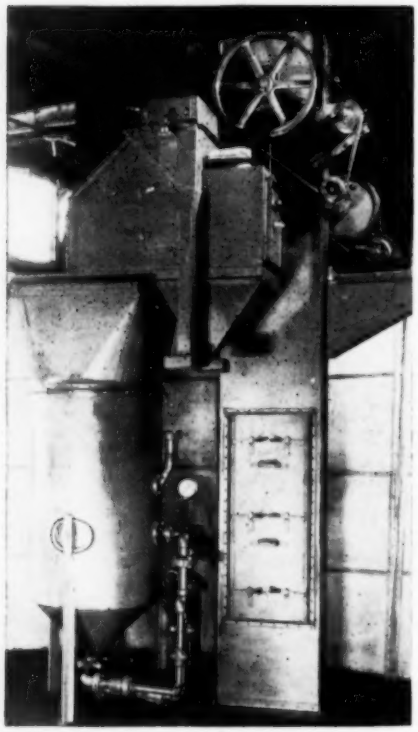
New Equipment



For Foundries

Removes Refuse And Fines from Abrasive

A pneumatic abrasive separator which removes coarse refuse and fines which have no abrasive value, and returns the usable material to the blast tank, recently has been introduced by the W. W. Sly Mfg. Co., 4700 Train avenue, Cleveland. A view of the separator installed with an elevator and a pressure blast tank is shown in the accompanying illustration.



The unit may be used in connection with blast cleaning rooms, tables, mills and cabinets

The unit, as illustrated, may be used in connection with blast cleaning rooms, tables, mills and cabinets. The spent abrasive together with dirt and refuse removed from the work is elevated and passed through a revolving screen in the upper portion of the separator housing. The coarse refuse enters a spout with an automatic discharge valve at the bottom. The material then passes over two curved sheds which distribute it in an even flow. Air is drawn through the material at the two points to remove the fines and the good abrasive drops into the storage hopper over the blast tank.

Several important features are provided in the design of the equipment. The abrasive is spread out evenly over the width of the separator to permit the air to make a thorough separation. Two points of separation are provided. Velocity of separating air currents may be adjusted by a sliding gate so that almost any desired separation may be obtained. The elevator is driven through V-belts from motor to intermediate shaft and from intermediate shaft to elevator head shaft. Both drives are adjustable by moving the motor on its slide rails and by adjustment of the idler.

The pressure blast tank shown in the illustration recently has been changed in design to reduce maintenance cost and to provide easy accessibility to all parts. No moving parts are located in the abrasive line.

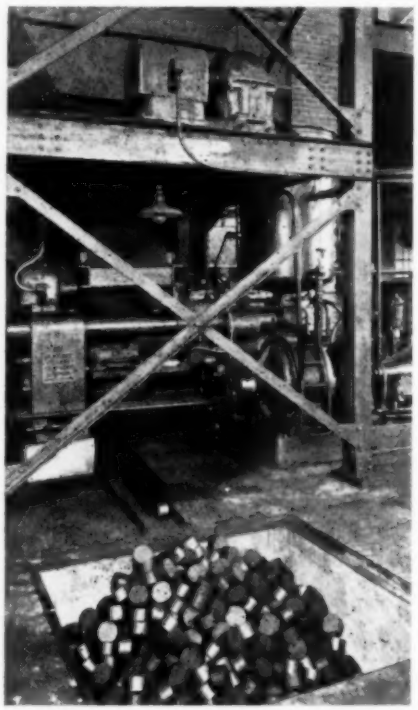
Reducers Have Low Operating Speeds

Gears and Forgings Inc., Cleveland, has introduced a speed reducer of the planetary type built integral with an electric motor and forming a single, neat and compact unit. The self-powered and self-contained type of reducer is designed particularly for applications where available space for the driving mechanism is limited.

The housing of the reduction gears is designed to be dust-proof and oil-tight. It is integral with the base which extends to the center line of the motor and also provides rigid support to the gearing and output shaft which carry the load. No additional loads are imposed on the motor shaft which is supported by two ball bearings. The planetary type of motorized speed reducer is built in 34 standard ratios ranging from 4:1 to 240:1 inclusive and in sizes ranging from ¼ to 30 horsepower thus rendering it available for a wide range of service.

Makes Briquets Under Uniform Pressure

A briqueting machine having a simple feed and stripping mechanism has been developed by the Milwaukee Foundry Equipment Co., 3238 West Pierce street, Milwaukee. The machine operates under 1500 pounds oil pressure which is supplied by a rotary piston type pump driven by a 50 horsepower motor. The oil circuit is closed and no accumulator is necessary.



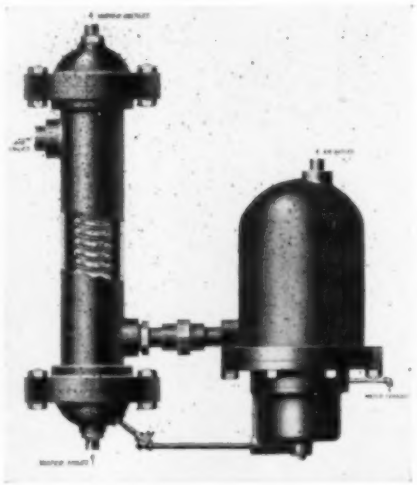
The machine has a capacity of 2¼ tons of briquets an hour

As the stroke of the machine is not fixed but the machine is reversed at a fixed pressure, each briquet is subject to the same pressure irrespective of length. It is pointed out that the briquets have a density of approximately 85 per cent of cast iron. The briquets are dropped at the center of the machine, as shown in the accompanying illustration, and can be directed on either side of the press as desired. The vibratory screen over the feed hopper

can be set so the tailings will discharge to either side. The average length of the briquet is 3 inches and the diameter of the briquet 4 inches. The average weight is 8 pounds and approximately 2¼ tons of briquets can be produced hourly. The total pressure exerted on a briquet is 330 tons.

Device Cools Air To Remove Condensate

James A. Murphy & Co., Hamilton, O., recently has introduced a device for cooling air immediately after compression, before or after entering the



The air cooler is shown at the left and the automatic moisture remover at the right

receiver, but before it enters the piping system. The device reduces the temperature to a point where the water and oil are condensed, the residue being removed by a hand drain, or preferably by an automatic trap.

The shell of the device is a steel tube with welded steel air connections enclosing a closely wound copper cooling coil which is fastened securely to each head. The heads and flanges are cast iron, heavily proportioned, machined and bolted together securely. Both heads and coil may be removed easily for inspection. The device is of the counter current flow design, which causes the coldest water to come in contact with the air as it is being discharged. This design uses a small amount of cooling water. The hot air is expanded immediately after it enters the device and travels a swirling course over the double helically corrugated surface of the cooling coils to the outlet, where preferably it is admitted to a separator which automatically expels the condensate.

The device for cooling the air is made in standard designs and capacities from 5 to 150 cubic feet of air per minute per single column and for pressures up to 150 pounds. They are designed so that any two columns can be coupled together for doubling the capacity.

Valve Is Suitable For Air, Oil or Water

Hanna Engineering Works, 1765 Elston avenue, Chicago, recently introduced a new line of valves which are suitable for air, oil or water at pressures up to 250 pounds per square inch. The valve is of the packless type and has an effective arrangement for lubrication of the moving parts. Balanced disk pressure throughout the contact area is secured by the arrangement of seat ports and disk pockets. The two-piece disk and stem rotate as a single unit. The operating handle may be adjusted to the most advantageous operating position. Valves may be used as straightway, 3-way or 4-way valves. Two inlet ports are provided to facilitate piping. It is claimed that circular lines of contact or scoring do not develop.

Electrical Device Records Temperature

A temperature recorder which measures the entire range from ice point to steam point and enables exacting control of temperatures in buildings, recently has been introduced by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. Tiny search coils are located in various parts of the building or in various rooms in the house and are connected to the electrical thermometer with small wires. The thermometer operates from an ordinary light socket. To determine the temperature of any part of building where the search coils are located, the operator merely turns the selector dial to the corresponding stop on the device and the temperature is indicated on the dial.

Small search coils are connected with thermometer

Flexible Coupling Uses New Type of Chain

Link-Belt Co., Indianapolis, has developed a new flexible coupling using the new type of roller chain recently introduced by the company. The new coupling consists simply of

The coupling has two cut tooth sprockets connected with roller chain

two cut-tooth sprocket wheels, or coupling halves, and a piece of roller chain to connect them. All working surfaces are machined to close tolerances. A pin and cotter link makes it easy to couple or remove the chain when desired. Where operating conditions suggest the advisability of protection from dust, dirt or other adverse conditions, the couplings can be enclosed in a stationary or revolving, automatically-lubricating, oil retaining casing.

Hoist Has Safety Overload Governor

A new type of high speed hoist with a special safety overload governor has been introduced by the Chisholm-Moore Hoist Corp., Tonawanda, N. Y. The unit is designed for efficient and economical operation on heavy duty service. A special feature is the adjustable load brake, which it is pointed out is positive in action, and prevents self-lowering of the load. Internal gears are packed in grease in an oil tight, dust proof housing.

Obituary

JOHN T. STONEY, former president of the Stoney Foundry Engineering & Equipment Co., Cleveland, died at his home in Lakewood, O., on July 28. Mr. Stoney was born in Cleveland on Jan. 17, 1862, and received his education in the Cleveland public schools. He began serving his time in 1877 in the Robert Gray Brass Foundry and completed

John T. Stoney

his apprenticeship in the Farnan Brass Works Co., Cleveland. He then went to Europe with the idea of spending a year in various foundries there, but the serious illness of his mother made it necessary for him to return to the United States a few months later. He worked for some time in the brass foundry of the Cleveland Shipbuilding Co. and the U. S. Bronze Co., both of Cleveland, and then accepted a position as brass foundry superintendent of the Westinghouse Machine Co., East Pittsburgh, Pa. Two years later the brass foundry was moved to Trafford city with Mr. Stoney continuing as brass foundry superintendent. In 1906 he returned to Cleveland and became connected with the Ferro Machine & Foundry Co. as general foreman. In 1907 he was made foundry superintendent and in 1918 foundry manager. In 1922 he was appointed factory manager and elected first vice president in which position he continued until his resignation in 1928. In 1920 Mr. Stoney organized the Stoney Foundry Engineering & Equipment Co. He retired from active business several years ago.

Burton C. Smith, 64, president, Smith Mfg. Co., LaCrosse, Wis., died at Chicago July 18. Mr. Smith for many years was an official of the LaCrosse Plow Co. and was active in civic affairs.

William A. Williams, 64, an assistant vice president of the American Car & Foundry Co., with which he had been associated since it was organized in 1899, died recently in New York.

Richard Asper, 52, foundry superintendent, Master Electric Co., Dayton, O., died recently while at work. Mr. Asper was born in Springfield, O., and had been a resident of Dayton for 25 years.

Herbert L. Flather, 58, president and treasurer, Flather Co., and treasurer, Hurlburt Rogers Machinery Co., Nashua, N. H., died July 7. He was a former police commissioner of that city, a director of the Second National bank, and active in the National Machine Tool Builders' association.

A. G. Lindberg, 63, general manager, U. S. Foundries Inc., Denver, died recently. Mr. Lindberg formerly was plant superintendent, Stearns-Rogers Mfg. Co., Pueblo, Colo., and went to Denver as plant manager of the General Iron Works. He joined the U. S. Foundries in 1930.

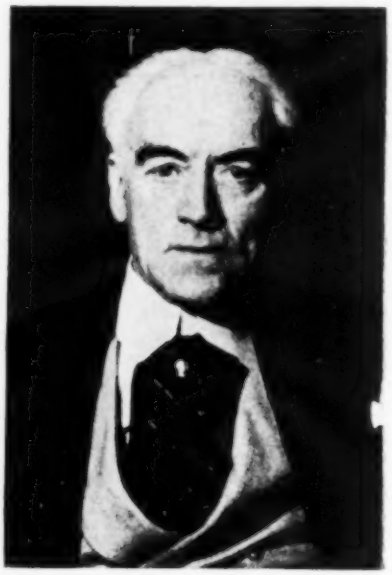
Bolling H. Jones, chairman, Birmingham Stove & Range Co., Birmingham, Ala., died July 13 at Atlanta, Ga. For many years he was president of the Birmingham company, following its organization in 1901. Later he moved to Atlanta where he became connected with the Atlanta Stove Works.

Louis C. Hirshheimer, 54, president, L. C. Hirshheimer Inc., LaCrosse, Wis., died recently. Mr. Hirshheimer was born in LaCrosse in 1879 and graduated from the public schools and later attended the University of Wisconsin and Cornell university. He then became associated with the LaCrosse Plow Co. and for many years was general superintendent of the foundry of that firm. In 1926 he resigned to establish his own company.

William Acheson Smith, 54 president, Acheson Graphite Corp., and vice president, National Carbon Co., died in Baltimore, July 12. Mr. Smith was graduated from the University of Pittsburgh in 1900 and then became connected with the Niagara Falls plant of the Acheson Graphite Corp., of which he was made president 15 years later. He was a past president of the Electric Chemical society and a member of the American Institute of Mining and Metallurgical Engineers.

Robert T. McCoy, 61, editor of the *International Molders Journal* died July 1 in Good Samaritan hospital Cincinnati. He was born in Murphreesboro, Tenn., Feb. 28, 1872 and learned the molding trade at the plant of Phillips & Buttorff Mfg. Co., Nashville, Tenn. Active for many years in local and international affairs of the molders' union he was elected editor of the *International Molders' Journal* in Dec. 1927, succeeding John P. Frey who resigned to accept the position of secretary-treasurer, metal trades department, American Federation of Labor.

Joseph KentSmith, consulting metallurgist, Climax Molybdenum Co. of Mich., Detroit, died at Battle



Joseph KentSmith

Creek, Mich., July 8. Mr. KentSmith was born in Liverpool, England, in 1869, and came to the United States in 1906 to participate in the development work of vanadium steel. When the Vanadium Corp. of America was organized, he became connected with the company and spent three years in its laboratories. In 1909 he returned to England to engage in special research work on special alloys for the British government. During the war he was decorated with the order of the British Empire. In 1925 he returned to the United States to become connected with the Climax Molybdenum company.

Resist Corrosion

Antaciron Inc., Wellsville, N. Y., is producing high silicon corrosion resistant castings having a silicon content from 14 to 15 per cent. Features claimed for the castings include strength, resistance to most alkalis and acids, freedom from shrinkage cavities or blowholes and the even distribution of carbon in the form of finely divided particles of graphite. James F. Campbell is president.

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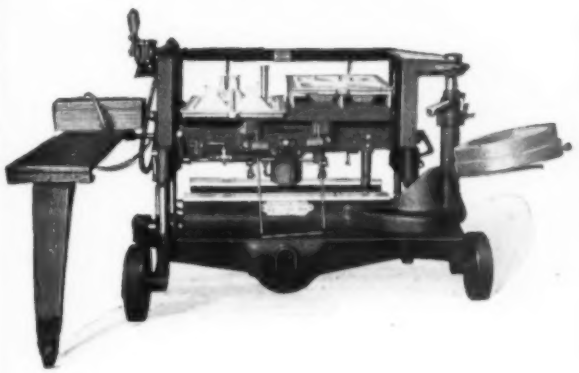
"MODERNS"



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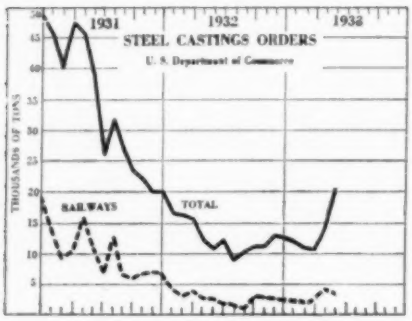
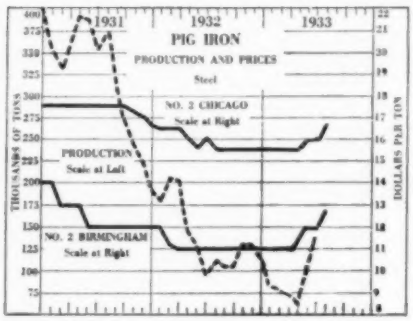
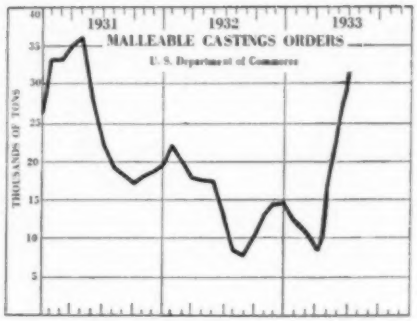






Foundry Activities

Reflect Industrial Trends

KALAMAZOO STOVE CO., Kalamazoo, Mich., is revamping the buildings of the old Kalamazoo Malleable Iron Co., idle for some years, providing a modern foundry capable of producing 80 tons of finished product a day, and thus relieving the main plant which reports a steady increase in business. A. L. Blakeslee is president, H. C. Buechner secretary, treasurer and purchasing agent, and Jack Asplan general superintendent.

* * *

Elmira Foundry Co., Elmira, N. Y., increased wages of its employes 5 per cent the first week in July.

* * *

Record Stove & Furnace Co., Moncton, N. B. plant has been severely damaged by fire.

* * *

Index of foundry equipment orders in June was 45.5 compared with 25.6 in May.

* * *

Fulton Brass Foundry Inc., 81-85 Clay street, Newark, N. J., is working on a full time schedule, according to John T. Barr, treasurer.

* * *

Foundry Services Inc., New York, has been incorporated to operate a foundry, by Bloom & Scherl, 25 West Forty-third street.

* * *

Foster Stove Co., Ironton, O., recently built a small extension to its foundry costing $1500. M. E. Marting is general manager.

* * *

National Pressure Cooker Co., 1515 Ball street, Eau Claire, Wis., has let contracts for remodeling and enlarging its foundry at cost of $20,000.

* * *

Richmond Radiator Co., North Beeson avenue, Uniontown, Pa., resumed operations in the manufacture of boilers and radiators in July.

* * *

Canadian Ohio Brass Co., Niagara Falls, Ont., subsidiary of Ohio Brass Co., Mansfield, O., plans erection of a foundry and factory on Stone road.

* * *

Farrel-Birmingham Co., Inc., Ansonia, Conn., recently raised the hourly wage rate in the Ansonia, Derby and Buffalo plants 10 per cent.

* * *

Wagner Mfg. Co., Fair avenue, Sidney, O., on July 1 increased production considerably by adding 126 employes to the plant payroll. Officials of that company report the increase in business is against the usual seasonal trend in the cooking utensil industry.

* * *

John Deere Plow Co., Moline, Ill., has bought a site 140 x 300 feet at Wilson and Violet streets, Los Angeles, on which it will build a plant.

* * *

Northern Indiana Brass Co., Elkhart, Ind., on July 15 reported considerably enlarged operations over April 1. The company payroll during that period was practically doubled.

* * *

Plans for reopening the Wapak Hollow Ware Co. plant, Wapakoneta, O., are being discussed by the business men of that city. The plant has been closed for six years.

* * *

C. Emrich Co., 127 West Fulton street, Columbus, O., resumed operations July 10, recalling approximately 125 former employes on full time.

* * *

Hart-Parr tractor plant of the Oliver Farm Equipment Co., Charles City, Iowa, resumed operations Aug 1 and will continue for at least 6 or 7 weeks.

* * *

American Brake Shoe & Foundry Co., New York, is operating its plant at Chattanooga, Tenn., at full time five days a week. R. E. Jones is superintendent.

* * *

Finch Mfg. Co., West Scranton, Pa., whose plant recently suffered severe damage by fire, plans construction of a shop and foundry to cost $70,000 or more.

* * *

Fairbanks, Morse & Co., Lawton avenue, Beloit, Wis., recently recalled 300 employes to its main works and reports an increase of 50 per cent in

RAW MATERIAL PRICES
Aug. 3, 1933

Iron	
No. 2 foundry, Valley	$16.50
No. 2 Southern, Birmingham	13.00
No. 2 foundry, Chicago	17.00
No. 2 foundry, Buffalo	17.00
Basic, Buffalo	16.50 to 17.00
Basic, Valley	16.00
Malleable, Chicago	17.00
Malleable, Buffalo	17.50
Coke	
Connellsville beehive coke premium	$4.00
Wise county beehive coke	3.00 to 4.25
Detroit by-product coke	8.00
Scrap	
Heavy melting steel, Valley	$13.00
Heavy melting steel, Pitts	12.00 to 12.50
Heavy melting steel, Chicago	10.50 to 10.75
Stove plate, Buffalo	9.00 to 9.50
Stove plate, Chicago	7.50 to 8.00
No. 1 cast, New York	7.00 to 7.50
No. 1 cast, Chicago	10.50 to 11.00
No. 1 cast, Pittsburgh	11.00 to 12.00
No. 1 cast, Philadelphia	11.50 to 12.50
No. 1 cast, Birmingham	9.00 to 9.50
Car wheels, iron, Pittsburgh	12.50 to 13.00
Car wheels, iron, Chicago	9.50 to 10.00
Railroad malleable, Chicago	11.00 to 11.50
Malleable, Buffalo	11.00 to 12.00
Nonferrous Metals	**Cents per pound**
Casting copper, refinery	8.75
Straits tin	45.00
Aluminum, No. 12, producers	19.00 to 22.00
Aluminum, No. 12 remelt Cleveland	12.50 to 13.50
Lead, New York	4.50
Antimony, New York	7.12½ to 7.25
Nickel, electro	35.00
Zinc, East St. Louis, Ill.	5.00

factory payroll since the middle of May. Improvement in business has been general throughout its diversified line.

* * *

Superior Foundry Inc., Buffalo has been incorporated with $10,000 capital to operate a metal foundry, by Chester H. Long, 24 Ross avenue, and associates.

* * *

Coosa Pipe & Foundry Co., subsidiary of the Alabama Pipe Co., Gadsden, Ala., resumed operations recently after being idle six months. Over 200 men were restored to the payroll.

* * *

Waltham Foundry Co., 71 Felton street, Waltham, Mass., has completely rebuilt its foundry which was damaged by fire recently. Thomas I. Curtain is president and treasurer.

* * *

Perfect Circle Co., Hagerstown, Ind., is reported operating its foundry at New Castle, Ind., five days a week with a daily production of 250,000 individual ring castings.

* * *

Anderson Stove Co., Anderson, Ind., recently resumed full time schedule and was reported subletting orders for castings to the Anderson Engine & Foundry Co., Anderson, thus increasing employment at the latter plant.

* * *

Century Die Casting Co., 188 West Randolph street, Chicago, has been incorporated with $20,000 capital to manufacture die castings in various metals, by Lester L. Bauer, 188 West Randolph street.

* * *

Department of commerce reports for automobile production in June show a total output of 253,322 cars. July production was equal to that of June, it is estimated.

* * *

Danville Malleable Iron Works, Danville, Ill., a subsidiary of Allith-Prouty Co. has ceased activities and operations have been transferred to the Decatur Malleable Iron Co., Decatur, Ill., which has been idle since February, 1932.

* * *

Moline Foundry & Machine Co., Third avenue and Sixth street, Moline, Ill., has increased operations 30 per cent during the past 2 or 3 months, according to S. S. Hoffman, president.

* * *

United States Pipe & Foundry Co., Birmingham, Ala., is making extensive improvements at its plant at Bessemer, Ala., installing centrifugal pipe machinery to increase its output materially.

* * *

Katelman Foundry & Mfg. Co., Third avenue and South Eleventh street, Council Bluffs, Iowa, is replacing its plant with a modern and fireproof building, 76 x 102 feet, costing $10,000. A. L. Katelman is manager.

* * *

Wisconsin Gray Iron Foundry Co., Milwaukee, reports a steady improvement in business since resumption of operations the first of July in its plant purchased from the J. I. Case Co. and located at 7225 West Main street, West Allis. J. A. Burke is president.

* * *

Chevrolet Motor Co. (Gray Iron Foundry), Saginaw, Mich., was pouring 1500 tons of iron a day at the middle of July. The Saginaw Malleable Iron Co., division of the General Motors Corp., was melting over 500 tons daily.

* * *

Production of malleable castings in June totaled 31,118 tons compared with 24,628 tons in May and 15,018 tons in June, 1932, according to the department of commerce. Orders increased from 24,671 tons in May to 31,997 tons in June.

* * *

Cadillac Malleable Iron Co., Cadillac, Mich., increased wages 16-2/3 per cent on July 1. The company previously had granted two wage increases, making a total additional compensation of 40 per cent above the low point of early spring. Ralph J. Teetor is general manager.

* * *

Fresnillo Co., Fresnillo, Mexico, recently installed an electric furnace for melting steel for its line of products which include cast steel tools, grinding balls, mill liners, and other steel castings. The furnace was supplied by the Pittsburgh Lectromelt Furnace Corp., Pittsburgh.

* * *

American Car & Foundry Co., New York, resumed operations at its Berwick, Pa., plant on July 17, after being idle since Jan. 1. Officials report that the increase in orders provides the brightest outlook in several years for the jobbing wheel business done by the plant.

* * *

Diamond Pattern & Mfg. Co., St. Antoine and Fort streets, Detroit, recently was organized by Hollis A. Place, James N. Giles and Matthew J. Fett. The company occupies two floors with approximately 3000 square feet of floor space on each, and has a working capacity for from 75 to 100 men.

* * *

Frank Foundries Corp., Moline Ill., and Davenport, Iowa., is experiencing a substantial improvement in business, according to A. E. Hagebeck, president. The Moline plant is operating 6 days a week, 100 per cent of capacity and the Davenport plant, which has been closed for several years, is increasing operations steadily.

* * *

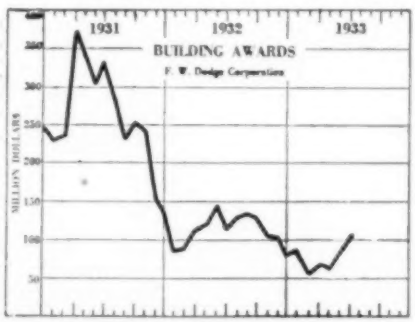
Production of gray iron castings in June was 94.7 per cent of normal, as compared with 79.4 per cent in May and 34.5 per cent in June, 1932, according to a recent report of the Gray Iron institute, Cleveland. The normal base is the average monthly production during the last 3 calendar years. Orders were 118 per cent of normal compared with 87.1 per cent for May.

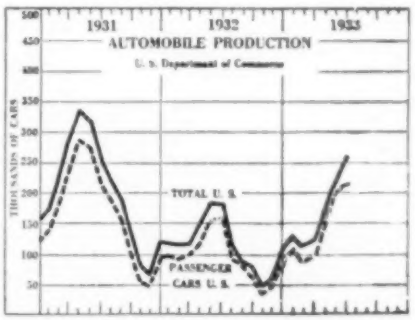
* * *

Walworth Co., Boston, recently increased prices on some of its products between 5 and 20 per cent. Prices of brass and iron body valves were increased 10 per cent, steel fittings and valves 20 per cent, cast iron fittings 15 per cent and malleable fittings 5 per cent. Prices of brass fittings remain unchanged. The present advance in prices is in addition to the 10 per cent increase put into effect on all products early in May.

* * *

George H. Smith Steel Casting Co., Milwaukee and its Trackson Co. division, manufacturing tractor equipment, dump wagons and pipelaying machinery, have been made separate entities. The Smith company has been reorganized with Mrs. Emma P. Smith, widow of George H. Smith, its founder, as president, J. B. Marshall vice president and sales manager, W. J. Donnelly secretary and general manager, and P. W. Kaufman treasurer. Walter H. Stiemke, vice president of the Smith company, becomes president of the Trackson Co., and also continues as general manager of that firm.





New Trade Publications

SAND PREPARING EQUIPMENT—A new development in the field of roll mill for preparing both natural and synthetic sand in continuous sand handling units is described and illustrated in a bulletin recently published by the Standard Sand & Machine Co., 549 West Washington street, Chicago. Various features are pointed out including change in angle of inclination, arrangement of rolls, operation of rolls, adjustment of rolls, and accessibility.

DIE CASTINGS.—Chicago Die Casting Mfg. Co., 2512 West Monroe street, Chicago, has published a bulletin giving information on dimensions of its line of couplings, flanges, collars, gears, bearings, hangers, pulleys and arbors.

FEEDERS.—Traylor Vibrator Co., 1400 Delgany street, Denver, has published bulletins describing its electric feeder for laboratory use and its feeder conveyors designed for industries requiring accurately controlled feeds.

WELDING RODS.—American Manganese Steel Co., 389 East 14th street, Chicago Heights, Ill., has published an illustrated bulletin on its nickel manganese steel welding rods, which may be used in the repair or reclamation of manganese steel castings.

ALLOYS.—Six sheets constituting the third edition of a series of data sheets designed to give information on various alloys supplied in the form of centrifugal castings recently have been published by the Shenango-Penn Mold Co., Dover, O.

METAL SPRAYING.—The process and equipment used in spraying metal coatings on various types of surfaces recently has been described in a folder published by the International Metallizing association, 214 Provost street, Jersey City, N. J.

PYROMETERS—Mishawaka Industrial Instrument Manufacturing Laboratory, 936 Washington avenue, Mishawaka, Ind., has published a folder describing and illustrating its line of indicating pyrometers for panel mountings, wall mountings, portable use and multiple point installations. Standard instrument ranges are from 800 to 3000 degrees Fahr.

MOTORS. — General Electric Co., Schenectady, N. Y., has published two bulletins, one describing an induction motor particularly suited to quiet operations, and a sound-isolating motor base designed to prevent natural periods of vibration from appearing within the permissible speed range of the motor and to provide good isolation for all impressed or forced audible-frequently vibrations.

MOTORS.—A line of motors having a built-in disk thermostat that functions before the temperature of the installation reaches the danger point recently has been shown in a catalog of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. The equipment is so designed that it is possible to arrange the control so that the motor will restart automatically when it has cooled to a base operating temperature. The Westinghouse company also has published a folder describing its electric boiler designed to generate steam for application requiring an accurately controlled supply, at high or low pressure, and in relatively limited quantity.

ROTARY FURNACE—Detailed information on the Sesci furnace is contained in a booklet recently published by the Societe des Enterprises Speciales de Chauffage Industrial, 6 Rue Calmels, Paris. The furnace is heated with pulverized fuel, which is mixed with air previously heated in a recuperator. Diagrams show the construction of the furnace.

SPEED REDUCER.—Smith Power Transmission Co., Penton building, Cleveland, has published a bulletin on a single unit mechanical device incorporating the over-running clutch principle. The speed range of the reducer is from zero to 240 revolutions per minute.

NAVAL STORES.—Hercules Powder Co., Wilmington, Del., has published an interesting book "The Growth of a Modern Hercules," which commemorates the twentieth anniversary of that company. The booklet tells a story of growth, diversification, research and development of new products and processes, including the production of naval stores.

LININGS.—A booklet illustrating and describing a new type of rubber lining for steel pickling tanks recently has been published by the B. F. Goodrich Rubber Co., Akron, O. The lining consists of a layer of hard rubber cushioned between two plies of resilient soft rubber. The three plies are vulcanized together to form an intrgral lining structure bonded to the steel tank.

ELECTRICAL PROTECTION EQUIPMENT—Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., has published a 96-page catalog entitled "Surge Protection" and containing information on the complete line of equipment made by that company for protection against surge in electrical installations.

SPEED REDUCER.—A combination of motor and speed reducer designed in a compact, self-contained and fully patented unit, is described in a recent bulletin of the Reliance Electric & Engineering Co., 1042 Ivanhoe road, Cleveland. The unit can be supplied for a wide range of ratios with both alternating current and direct current motors of various types.

VIBRATORS—A valve type vibrator for molding machines, matchplates, benches, sand chutes, dust arrestors, and other types of installations is described in a bulletin recently issued by the Berkshire Mfg. Co., 1101 Power avenue, Cleveland. A feature claimed for the vibrator is the absence of a spring in the piston.

MELTING—Whiting Corp., Harvey, Ill., has published a catalog entitled "Modern Melting Methods" in which information is presented on the melting of metal in the cupola, the powdered coal fired rotary type furnace, the converter, and the powdered coal fired air furnace. Information on the mechanical charging of cupolas also is included.

TRANSMISSION MACHINERY—A souvenir book of the Link-Belt Exhibit at A Century of Progress, Chicago, entitled "Serving Industry's Needs in Handling of Materials and the Positive Transmission of Power" contains reproductions of photographs and descriptions of the various types of transmission equipment manufactured by the Link-Belt Co., 910 South Michigan avenue, Chicago.

ELECTRIC FURNACES — Ajax Electrothermic Corp., Ajax Park, Trenton, N. J., has published a four page folder describing and illustrating its 3 KV-A equipment and its 35 KV-A equipment, including converters, furnaces, and equipment for heat treating. It is pointed out that with the 35 KV-A equipment and a 17-pound furnace, 17 pounds of pure iron can be melted without presence of carbon and poured in 40 minutes, starting with a hot furnace.

NICHROME — The Driver-Harris Co., Harrison, N. J., recently has published a 60-page catalog designed to cover the properties and characteristics of alloys for electrical, mechanical and chemical purposes. The text includes data and other information on Nichrome and various other alloys manufactured by that company. Under the heading "Useful Data" information is given on the properties of metals and alloys. A charge of 25 cents is made for this volume.

STAINLESS STEEL CASTINGS—Lebanon Steel Foundry, Lebanon, Pa., has published an interesting booklet on its line of alloy steel castings for high stresses and wear resistance. A new 5 per cent chromium alloy with molybdenum, designed to meet requirements of refiners for oil-still parts, and combining high strength and resistance to corrosion, is discussed. Further information covers alloy steel castings for corrosion resistance and heat resistance.

Faked Foundry Facts

Sandblast